Financial report | 2021

Key financial indicators for the Group

	2021	2020	Change (%)
Financial performance (€ million)			
Revenue excluding precious metals	2,272	2,052	+10.7
Total revenue	29,506	31,532	−6.4
Earnings before interest and tax (EBIT)	524	302	+73.5
Profit after taxes	369	191	+93.2
Financial position (€ million)			
Total assets*	6,994	5,915	+18.2
Shareholders’ equity	3,801	3,280	+15.9
Equity-to-assets ratio (%)*	54	56	
Cash flow (€ million)			
Net cash provided by operating activities	608	345	+76.2
Cash payments for investments in non-current assets	248	197	+25.9
Depreciation, amortization, and impairment of non-current assets	168	176	−4.5
Employees			
Employees at year-end	15,114	13,911	+8.6
In Germany	5,149	5,290	−2.7
Outside Germany	9,965	8,621	+15.6

* The comparative information for 2020 has been restated; see note (2)(b) of the notes to the consolidated financial statements.

Heraeus 2025

In the next 5-10 years we expect some tectonic changes in the geopolitical landscape, social ecosystems and the overall business environment.

Furthermore, technological advancement and rapidly changing customer demands in relevant markets of the Heraeus Group will lead to increasing competitive pressure on one side and new business opportunities on the other side.

To continue the history of the Heraeus Group, to continue our path of sustainable growth and to create superior value for our shareholders we focus on five major areas of activities until 2025:

1. We will strengthen the Heraeus Group's portfolio of diversified businesses with substantial investments

2. We will develop the degree of independence of the individual businesses of the Heraeus Group to enable the businesses to focus on their specific missions and opportunities

3. We will improve the competitiveness of each of the Heraeus Group's businesses through customer focus, innovation and excellence to outperform the competition

4. We will leverage partnerships, networks and cooperation with market participants, customers, suppliers and other partners to achieve great results

5. We will make the Heraeus Group and its businesses an attractive place to work

Letter from the Board of Managing Directors

Ladies and Gentlemen,

Overall, 2021 was a successful and eventful year for the Heraeus Group. We benefited from a palpable increase in demand in many markets. The fields of activity Environmental and Industrials, in particular, performed better than expected. Both the revenue excluding precious metals and the profit generated by the Heraeus Group in 2021 exceeded expectations.

The Group's total revenue amounted to €29.5 billion in 2021. Revenue excluding precious metals increased by 10.7 percent year on year to €2.3 billion. At €369.3 million, the profit after taxes generated in 2021 was also higher than forecast. This was attributable to focused business development, operational improvements, and effective cost-reducing measures. Persistently strong volatility in the markets for precious metals also boosted profitability.

Many of our operating businesses were able to bring groundbreaking new products to the market. For example:

- In the field of activity Environmental, a new generation of catalysts for PEM electrolysis was launched that will play a crucial role in the production of green hydrogen.

- In the fight against the pandemic, a globally renowned study proved that Heraeus' UV air purifiers – another product from the field of activity Environmental – reliably deactivated virus particles and bacteria in a room.

- In the field of activity Health, the system solutions for neuromodulation – a treatment whereby certain nerves are stimulated with electrical impulses – have proved a very successful therapeutic concept with huge potential for growth.

Global infrastructure measures that were completed in 2021 also reflected the positive strategic focus of the operating businesses. For example:

- In the field of activity Electronics, a new factory for organic chemicals for the semiconductor industry was opened in Vandalia, Ohio, USA.

- The precious metals segment of the field of activity Environmental moved into its new headquarters in a modernized office building in Hanau, Germany. Now, all functions are based in the same building.

All in all, we have laid some important groundwork this year and have further developed the operational leadership model of the Heraeus Group. The aim is to give the operating businesses of the Heraeus Group the independence and flexibility they need to be able to respond quickly and decisively to potential changes in the market and to make focused use of opportunities. This approach strengthens the competitiveness of the operating businesses and enables them to add more value.

The operating businesses are supported by central teams of experts in the areas of excellence, digitalization, and IT and benefit from certain services provided by central functions.

Heraeus Holding will focus on managing the Group at an overarching level, identifying and further developing key management functions, providing financial resources, managing the performance of the individual operating units, and managing the business portfolio.

This new setup has created scope for a number of M&A projects to be pursued and for some key acquisitions and investments to be made:

- In the US, we were able to significantly expand our global presence in the healthcare sector by acquiring Norwood Medical LLC. Based in Dayton, Ohio, Norwood Medical is a leading full-service provider of medical components for minimally invasive surgical instruments, robot-assisted surgery, and orthopedic markets.

- Another element of our strategic expansion was the acquisition of Mo Sci LLC and ETS Wound Care, LLC based in Rolla in the US state of Missouri. Mo Sci and the start-up ETS are providers of medical specialty glass for innovative wound care technologies, in particular the treatment of chronic wounds.

- In addition, we strengthened our field of activity Industrials by increasing our investment in revalyu, which uses an innovative technology to recycle PET bottles into a sustainable PET polymer material. The technique has been in use for several years and has proved very eco-friendly at the first production site, which is located in Nashik, India.

In addition, the Heraeus Group invested, or increased its investments, in various start-ups, venture capital projects, and start-up founder funds.

2021 was once again characterized by the challenges associated with the ongoing restrictions and pressures of the coronavirus pandemic. The exemplary cooperation and discipline of our employees helped to prevent large-scale outbreaks of coronavirus at our sites worldwide. A key factor in this context was that thousands of colleagues took up our offer to get vaccinated against the virus at our Heraeus sites all over the world. We would like to take this opportunity to thank all employees of the Heraeus Group for their support and cooperation in this challenging second year of the pandemic.

Now, we are looking ahead with a sense of optimism. As many market segments showed clear signs of recovery in 2021, the Heraeus Group expects sales markets to normalize further in 2022. Alongside rising inflation and other general macroeconomic trends, factors such as the availability of coronavirus vaccines and the proportion of vaccinated people in the population will have a crucial impact on the economic recovery. The Heraeus Group anticipates that revenue excluding precious metals will increase in 2022. All fields of activity are likely to contribute to this growth, albeit to varying degrees.

The Heraeus Group predicts a slight year-on-year decline in profit after taxes in 2022 as a result of the continuing normalization of conditions in the precious metal markets. Nonetheless, the excellence initiatives implemented in past years will continue to have a positive impact.

The Board of Managing Directors of Heraeus Holding GmbH

Jan Rinnert
Chairman

Dr. André Kobelt

Dr. Frank Stietz

Rolf Wetzel

Management and Supervisory Bodies of Heraeus Holding GmbH

Board of Managing Directors of Heraeus Holding GmbH

Jan Rinnert Chairman

Dr. André Kobelt

Dr. Frank Stietz

Rolf Wetzel

Supervisory Board of Heraeus Holding GmbH

Franz Haniel Chairman

Florian Pieroth Vice Chairman (since June 5, 2021)

Joachim Reitz Vice Chairman (until June 4, 2021)

Dr. Simone Bagel-Trah

Dr. Hans-Tjabert Conring

Birgit Heraeus-Roggendorf

Dr. Hubert Lienhard

Annette Lukas

Uwe Raschke

Stefan Sattler (until June 4, 2021)

Peter Schuld

Gerhard Schullerus (until June 4, 2021)

Andreas Wolf (until June 4, 2021)

Dr. Markus Binder (since June 5, 2021)

Dr. Martina Gieg (since June 5, 2021)

Christian Stübing (since June 5, 2021)

Report of the Supervisory Board

Dear shareholders,
dear readers,

In 2021, the Supervisory Board diligently performed the monitoring and advisory duties incumbent upon it by law, the articles of association, and its rules of procedure. The following topics were of particular note in the reporting year:

The Supervisory Board dedicated significant time and thought to the development of the Group's portfolio. At relevant meetings, the Board of Managing Directors set out how a structured portfolio management approach could help the Group and its portfolio companies, which carry out the Group's operations, to achieve further value creation and growth in the future. At these meetings and further dedicated information events, the Supervisory Board also discussed a variety of M&A projects.

After the newly elected employee representatives took up their positions on the Supervisory Board, several workshops were conducted to introduce them to the Supervisory Board's responsibilities and work procedures and to familiarize them with important aspects such as accounting concepts of relevance to their work on the Supervisory Board.

Over the whole of 2021, the Supervisory Board and the Board of Managing Directors collaborated closely and shared information on an ongoing basis.

In the meetings, the Board of Managing Directors provided the Supervisory Board with a summary of the performance, portfolio development, and prospects of the individual business units and the Group as a whole. The Supervisory Board and the Board of Managing Directors discussed all fundamental matters of corporate policy, portfolio management, organization, and strategy in depth at these meetings, including in particular the Group's risk situation and risk management systems, compliance issues, and Group Internal Audit. The Board of Managing Directors also briefed the Supervisory Board on the Group's performance over the course of the year by means of quarterly reports.

In addition, business transactions requiring Supervisory Board approval in accordance with the law and the articles of association were scrutinized and discussed at the meetings and information events. The Supervisory Board voted on the reports and recommendations of the Board of Managing Directors, in so far as this was required by law and the articles of association, after having comprehensively reviewed and discussed them. Detailed written resolutions on pertinent matters were prepared and the Board of Managing Directors answered any questions raised.

In addition to the meetings mentioned above, the Chairman of the Supervisory Board also maintained close contact with the Board of Managing Directors. He was regularly and comprehensively informed without delay of significant business transactions and current events of importance for assessing the situation and performance of the Group and its management. He also advised the Board of Managing Directors in its strategic decisions, in particular with regard to acquisition projects within the Group.

Throughout the reporting period, the Supervisory Board comprehensively fulfilled its duty to monitor the Board of Managing Directors.

Supervisory Board meetings, written resolutions, and information events

Three meetings of the Supervisory Board, together with a constitutive meeting, took place in 2021. Two written resolutions, which were accompanied by information events, were circulated for approval outside the meetings. The Board of Managing Directors also kept the Supervisory Board comprehensively informed of all current issues.

As is customary, all meetings took place in an open and constructive atmosphere both within the Supervisory Board and vis-à-vis the Board of Managing Directors. This was perfectly possible, even in the partially virtual format used for the three meetings, as necessitated by the pandemic. All members of the Supervisory Board participated in all meetings. The Board of Managing Directors answered questions from members of the Supervisory Board in detail ahead of, during, and after the meetings and information events.

At its meeting on April 29, 2021, the Supervisory Board discussed at length the implementation of a portfolio management concept and the roles that this would create for the holding company and the individual portfolio companies. With regard to the structured strategic implementation of the portfolio management concept, the Board of Managing Directors proposed that a dedicated value creation plan for future growth be developed for each individual portfolio company.

Moreover, the Supervisory Board discussed, in the presence of the auditors, the single-entity financial statements of Heraeus Holding GmbH and the consolidated financial statements of Heraeus Holding GmbH for the year ended December 31, 2020, in each case including the management report. It did not raise any objections to these financial statements and approved them after a review and thorough deliberation. Because of the coronavirus pandemic, the Supervisory Board also addressed the pandemic-related cancellation of the shareholders' meeting that had been planned to be held on May 29, 2021 with physical attendance. It also approved the proposal to adopt the relevant shareholders' resolutions in writing in the period May 20, 2021 to June 4, 2021, in combination with a virtual information event for shareholders. The documents focused on resolutions covering the formal approval of the actions of the Board of Managing Directors and Supervisory Board, the appropriation of profit, and the appointment of the independent auditors for the single-entity and consolidated financial statements. The Board of Managing Directors reported on the 2020 financial year and on the current financial year, which included a risk report.

At the constitutive meeting of the Supervisory Board on June 9, 2021, Franz Haniel was confirmed as Chairman and Florian Pieroth was elected as Vice Chairman. Some new members were elected to the Presidial Committee and the committees of the Supervisory Board.

The Board of Managing Directors distributed a written proposal on June 15, 2021 and held an additional information event on June 28, 2021 to provide detailed information on a planned acquisition that ultimately did not come to pass. A conflict of interest was identified for one member of the Supervisory Board in relation to the transaction. It was therefore agreed with the Board of Managing Directors that the affected member of the Supervisory Board would neither be included in the distribution of relevant documentation nor participate in the adoption of the associated written resolution by the Supervisory Board.

The Board of Managing Directors distributed a written proposal on June 17, 2021 to provide detailed information on the planned acquisition of 100 percent of the shares in Mo Sci LLC (formerly Mo-Sci Corporation) and ETS Technology Holdings LLC, including 100 percent of the shares in ETS Wound Care, LLC. At a dedicated information event on July 9, 2021, the Board of Managing Directors provided an update on the progress of negotiations and answered questions from members of the Supervisory Board. The Supervisory Board approved the acquisition by written resolution. The purchase agreement was signed on September 15, 2021 and took effect on December 21, 2021.

In a written proposal dated October 14, 2021, the Board of Managing Directors shared information about a potential acquisition of 100 percent of the shares in Norwood Medical LLC based in Dayton, Ohio, USA. In addition, the Board of Managing Directors presented a detailed report on the reasons for the acquisition of this company and an update on the status of the negotiations at a dedicated information event on November 1, 2021.

At its meeting on November 4, 2021, the Supervisory Board approved the purchase of 100 percent of the shares in Norwood Medical LLC and agreed to the necessary increase of the approved borrowing framework. The purchase agreement was signed on November 5, 2021 and took effect on December 14, 2021.

At its meeting on December 16, 2021, the Board of Managing Directors reported on the development of the portfolio and the value creation plans of Heraeus Conamic and Heraeus Medical Components, and provided an update on the status of several M&A projects. In addition, the Board of Managing Directors also presented a detailed report on earnings at Heraeus Conamic in recent years, which had been requested by the Supervisory Board.

Moreover, the Board of Managing Directors reported to the Supervisory Board in detail on the current financial year, digitalization initiatives within the Group, sustainability-related topics within the Group (pertaining to environmental, social, and corporate governance matters), and the ten most significant risks. The meeting also received a presentation on the Heraeus Group's planning for 2022 to 2024, including the borrowing framework. The planning was reviewed in depth and approved.

At the same meeting, the Supervisory Board passed a resolution to reappoint Dr. André Kobelt as a member of the Board of Managing Directors. The Supervisory Board was also informed about changes to the Managing Director contract of Dr. Frank Stietz, who will be taking over the management of Norwood Medical LLC.

Finally, the report on the review in accordance with the European Market Infrastructure Regulation (EMIR) was presented to the meeting.

Meetings and resolutions of the committees

The Supervisory Board's Audit Committee met three times in 2021.

At its meeting on March 25, 2021, it mainly dealt with the single-entity and consolidated financial statements for 2020, including the auditor's key audit points. In addition, the Board of Managing Directors presented an overview of portfolio management activities and current M&A projects. The auditors responsible for the audit participated in this meeting.

At its meeting on September 23, 2021, the Audit Committee primarily dealt with the Group's 2021 half-year report and with current business performance, and discussed the key areas of focus for the audit of the 2021 annual financial statements. In this context, the Board of Managing Directors reported on the full-scale stocktake in the recycling business of Heraeus Precious Metals in Hanau, which resulted in a positive contribution to earnings. It also received reports on the current status of M&A projects.

The meeting on December 16, 2021 mainly addressed current performance, the responsibility management system, the risk management system, and Group Internal Audit. Other agenda items covered matters relating to portfolio management, the status of current M&A projects, and the key areas of audit focus proposed by the auditors for the 2021 consolidated financial statements. In addition, the Audit Committee adopted a resolution on the next scheduled tender process for the selection of an independent auditor for the consolidated financial statements. Advances in digitalization and environmental, social, and corporate governance (ESG) aspects were also discussed.

The Supervisory Board was informed of the activities of the Audit Committee at the Supervisory Board meetings following each of these meetings.

The Presidial Committee of the Supervisory Board convened once during the reporting period, on December 15, 2021. At this meeting, the committee approved the conclusion of a Managing Director employment contract with Dr. André Kobelt, subject to approval by the Supervisory Board, and the changes to the Managing Director employment contract of Dr. Frank Stietz.

Mediation Committee meetings

Meetings of the Mediation Committee were not necessary during the reporting period.

Single-entity financial statements of Heraeus Holding GmbH and consolidated financial statements of Heraeus Holding GmbH

The single-entity financial statements and management report of Heraeus Holding GmbH as well as the consolidated financial statements and group management report of the Heraeus Group for 2021 were audited by Ernst & Young GmbH Wirtschaftsprüfungsgesellschaft, Eschborn, and given an unqualified audit opinion.

The Supervisory Board issued the engagement for these audits at its meeting on April 29, 2021. The shareholders approved the audit engagement by means of a written resolution over the period May 20, 2021 to June 4, 2021.

In addition, the Supervisory Board's Audit Committee discussed the single-entity financial statements of Heraeus Holding GmbH and the consolidated financial statements for 2021, together with the related audits, at its meeting on April 5, 2022. The Audit Committee accepted the findings of the audits with no objections. The auditor also participated in this meeting.

The single-entity financial statements and the management report of Heraeus Holding GmbH and the consolidated financial statements and group management report of the Heraeus Group for 2021, along with the auditors' reports, were made available to all members of the Supervisory Board in advance of the full Supervisory Board meeting on April 27, 2022.

At the meeting, the auditors participated in the Supervisory Board's discussion of the documents to be reviewed. They reported on the most important findings of their audit and were available to answer questions.

The Supervisory Board comprehensively reviewed the single-entity financial statements and management report of Heraeus Holding GmbH, together with the consolidated financial statements and group management report of the Heraeus Group, prepared for the 2021 financial year, including the associated audit reports. The Supervisory Board's concluding findings of its own review were that there were no objections to be raised. Accordingly, the Supervisory Board approved the single-entity financial statements and management report of Heraeus Holding GmbH, along with the consolidated financial statements of Heraeus Holding GmbH and the group management report.

The Supervisory Board reviewed and approved the Board of Managing Directors' proposal for the appropriation of profits.

Changes to the Supervisory Board of Heraeus Holding GmbH

Over the period from April 20, 2021 to April 22, 2021, elections were held for the employee representatives on the Supervisory Board of Heraeus Holding GmbH. Dr. Markus Binder, Dr. Martina Gieg, Annette Lukas, Florian Pieroth, Peter Schuld, and Christian Stübing were elected. Their term of office commenced on June 5, 2021.

The previous members Joachim Reitz (Vice Chairman), Stefan Sattler, Gerhard Schullerus, and Andreas Wolf left the Supervisory Board on this date.

The term of office of Dr. Simone Bagel-Trah ended on June 4, 2021. She stood again as a candidate and was re-elected for a term of five years, as specified in the articles of association, by way of a written resolution passed in the period from May 20, 2021 to June 4, 2021.

At the constitutive meeting of the Supervisory Board on June 9, 2021, Florian Pieroth was elected Vice Chairman of the Supervisory Board.

Changes in the Supervisory Board committees

The aforementioned elections also affected the committees of the Supervisory Board. Following the constitutive meeting on June 9, 2021, the committees were composed as follows.

Presidial Committee of Heraeus Holding GmbH

Franz Haniel, as Chairman of the Supervisory Board, remains a member of the Presidial Committee and is joined by the newly elected Vice Chairman Florian Pieroth. Dr. Simone Bagel-Trah was re-elected by the Supervisory Board as the third member of the Presidial Committee.

Audit Committee of Heraeus Holding GmbH

Dr. Hubert Lienhard and Franz Haniel remain in post as Chairman and Vice Chairman of the Audit Committee respectively. Annette Lukas was elected by the Supervisory Board as a new member of the Audit Committee. Birgit Heraeus-Roggendorf was invited to meetings of the Audit Committee as a standing guest member.

Mediation Committee of Heraeus Holding GmbH

Franz Haniel, as Chairman of the Supervisory Board, remains a member of the Mediation Committee and is joined by the newly elected Vice Chairman Florian Pieroth. Dr. Simone Bagel-Trah was re-elected by the Supervisory Board as a member of the Mediation Committee and Christian Stübing was elected as an additional member.

Changes to the Board of Managing Directors of Heraeus Holding GmbH

Dr. André Kobelt was reappointed as a member of the Board of Managing Directors for a further term of three years with effect from January 1, 2022.

The Supervisory Board would like to offer special thanks to all members of senior management and the works councils of the Heraeus Group, as well as to each and every employee, for their hard work and dedication throughout the past year, during which the coronavirus pandemic continued to pose extraordinary challenges.

Hanau, April 27, 2022
The Supervisory Board

Franz Haniel
Chairman

Group management report. Heraeus exceeded its own revenue forecasts in 2021. Profit after taxes also surpassed expectations. This was due in part to systematic improvements to operations and the successful implementation of cost-reducing measures, but also in particular to persistently strong volatility in the markets for precious metals, which boosted profitability.

Fundamentals of the Group

Business model

Heraeus, the technology group headquartered in Hanau, Germany, is a global family-owned portfolio company. The company was incorporated in 1851 and can trace its roots back to a pharmacy opened by the family in 1660. Today, Heraeus encompasses a large number of businesses that operate in the fields of activity Health, Electronics, Industrials, and Environmental. Based on its range of products, the Group is one of the leading providers in each of its global sales markets. These include the markets for electronics, medical equipment, semiconductors, telecommunications, lighting, chemicals, pharmaceuticals, steel, photovoltaics, and automotive products.

Under the umbrella of Heraeus Holding, the Group's four fields of activity remained unchanged in 2021. In the field of activity Health, Heraeus operates as a provider of components and solutions for medical equipment as well as biomaterials. The field of activity Electronics supplies customers with materials and integrated materials solutions in packaging technology and with high-purity quartz glass. In Industrials, Heraeus provides its customers with measurement equipment for high-temperature processes as well as sensor and electrochemical solutions. This field of activity also includes all the Group's start-up activities. The activities pooled under the field of activity Environmental make a contribution to resource-efficient power generation and product manufacturing. They include products for the photovoltaic industry, specialty light sources for industrial production, and precious metal services and products. The Corporate unit brings together the central corporate functions.

Heraeus Holding is responsible for the corporate strategy of the Group, which controls the fields of activity. Preserving the long-term independence of the Group has priority in all corporate decisions. The key financial performance indicators relevant to the management of the business are total revenue, revenue excluding precious metals, earnings before interest and tax (EBIT), and profit after taxes. When looking at total revenue, it must be borne in mind that this figure is heavily influenced by the volatility of precious metal prices.

With over 120 companies and more than 15,100 employees, Heraeus maintains a presence in the key economic regions of the world in order to capitalize on growth opportunities around the globe.

Research and development

Technological expertise and innovation capabilities are the key drivers of success for the Heraeus Group. Heraeus currently holds over 1,300 patent families, with property rights in various countries, and employs more than 940 people in research and development (R&D). Its research and development expenditure in 2021 amounted to €138.4 million.

Numerous interdisciplinary and international R&D projects were initiated and progressed last year, aided by a consolidation of R&D activities in the innovation centers. The following sections provide a detailed description of the key activities in the individual fields of activity.

Economic report

Macroeconomic and sector-specific conditions

The effects of the worldwide coronavirus pandemic continued to shape global economic growth in 2021. By spring 2021, vaccines were available in virtually all industrialized nations and economic life began returning to normal. However, the emergence of new variants of the virus and the associated rise in infection rates prevented economic activity from recovering fully. As a result, growth forecasts as a whole were cut sharply over the course of 2021. The latest figures published by the International Monetary Fund (IMF) predict that the global economy will have grown by 5.9 percent in 2021 compared with the previous year.

The general economic recovery is likely to vary widely from region to region and country to country. While growth of 5.6 percent is forecast for the US (2020: contraction of 3.4 percent), for the eurozone the IMF is anticipating growth of 5.2 percent (2020: contraction of 6.4 percent). The rate of recovery in Germany lags further behind that of other countries, with expected growth of 2.7 percent (2020: contraction of 4.6 percent). A particularly strong economic revival is expected for China, with a growth rate of 8.1 percent (2020: 2.3 percent). A similar pattern is expected overall for the emerging markets and developing countries, where growth at 6.5 percent (2020: contraction of 2.0 percent) is set to comfortably exceed that of the prior year.

While 2020 was particularly impacted by direct measures to control the pandemic, such as lockdowns and contact restrictions, some markets experienced further indirect effects in 2021. Supply chains remained disrupted in some sectors, leading to supply shortages, and the general economic recovery led to increased demand for commodity, which was reflected in sharply rising commodity prices. Like most other markets, the sales markets served by Heraeus did not escape the effects of this trend in 2021, although many of them still managed to achieve encouraging growth.

The semiconductor market grew substantially in 2021. Driven by a general recovery in economic growth and the accelerating pace of digitalization, chip production increased by 18 percent year on year. Capital expenditure in semiconductor manufacturing facilities was up by 41 percent year on year. The main driver of the additional investment is the currently very high level of capacity utilization in global chip production, which is unable to keep pace with current market demand.

Total revenue
€ million

Revenue excluding precious metals
€ million

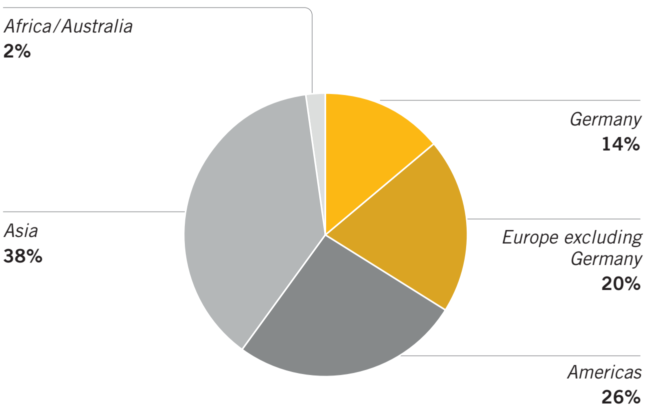
Following a decline in the market for the optical fiber used in telecommunications and data transmission in 2020, there was a sharp rebound in 2021. Year-on-year market growth of 14 percent is expected, due largely to the comprehensive new subsidy programs for broadband networks using optical fiber to the home (Fiber-to-the-X; FTTx) in industrialized nations and the globally accelerated expansion of the 5G cellphone network.

Global demand for steel also recovered significantly in 2021. Following a slump in 2020 as a result of the worldwide coronavirus pandemic, global demand for steel is expected to have increased by 4.5 percent in 2021, driven by higher volumes of capital expenditure in the construction and capital equipment markets.

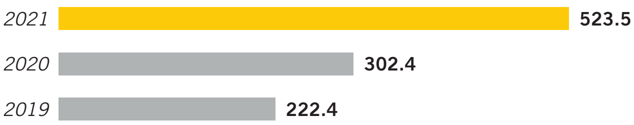
The photonics business (optics industry focusing on research, medical equipment, and laser technology) also saw a market recovery. Demand for industrial lasers rose sharply in 2021, as did demand for medical laser applications and applications in measurement technology, which benefited in particular from a greater need in the semiconductor and medical technology industries.

Demand for medical solutions largely recovered in 2021 and the market resumed the upward trend seen in the pre-pandemic years. While elective surgery was still being postponed in the first half of 2021, the situation normalized in the second half of the year. This was reflected in particular in increased demand for bone cement resulting from the growing number of orthopedic operations. The market for medical solutions also continued to benefit from the steady trend in this area. While an aging population and unhealthy lifestyle were partly responsible for rising demand, the intro-

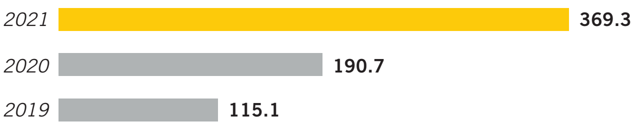
Revenue excluding precious metals by region 2021



Earnings before interest and tax (EBIT)
€ million



Profit after taxes
€ million



duction of new products and therapies and the growing use of medical equipment in the emerging markets and developing countries were particularly strong drivers.

In contrast to the sales markets referred to above, some markets of relevance to Heraeus faced major challenges.

The automotive market declined again in 2021, due to the worldwide chip shortage and the production restrictions faced by vehicle manufacturers as a result. The Center for Automotive Research (CAR) expects vehicle production in Germany to contract by 19 percent year on year.

The high prices for the raw materials used in polycrystalline silicon contributed to the decline in solar cell production, which was reflected in lower demand for silver conductive paste. Although demand for renewable energies remains high, some of the world's largest solar cell manufacturers significantly cut production because of the high price of raw materials.

Comparison between actual and forecast business performance

Anticipating a rebound, Heraeus forecast that revenue would return to the pre-pandemic level in 2021. Revenue excluding precious metals was higher than predicted at €2.3 billion, which was up by 10.7 percent on the prior year, despite negative currency effects.

With the exception of Electronics, all fields of activity exceeded their forecast – in some cases significantly. The fields of activity Environmental and Industrials in particular surpassed expectations.

At €369.3 million, the profit after taxes generated in 2021 was also higher than predicted. This was due in part to systematic improvements to operations and the successful implementation of cost-reducing measures, but also in particular to persistently strong volatility in the markets for precious metals, which boosted profitability.

Business performance, financial position, and financial performance

Total revenue fell from €31.5 billion to €29.5 billion, a year-on-year decrease of 6.4 percent. Revenue excluding precious metals rose by 10.7 percent year on year to reach €2.3 billion. The increase was 11.7 percent after adjusting for currency effects.

Asia remained the strongest region in terms of revenue excluding precious metals, accounting for 38.5 percent of the total. Revenue in this region rose by 2.1 percent year on year. A year-on-year increase in revenue excluding precious metals was also reported in Europe (up by 16.5 percent).

Detailed breakdowns of revenue performance in the individual fields of activity are provided in the subsequent sections.

The Group's earnings before interest and tax (EBIT) amounted to €523.5 million in 2021, a substantial €221.1 million increase on the prior-year figure of €302.4 million.

Despite a decrease in total revenue, Heraeus reported a significant rise in gross profit – the difference between revenue generated and materials consumed (including change in

Consolidated income statement

€ million	2021	2020	Change
Revenue	29,506.4	31,531.8	–2,025.4
Cost of materials incl. change in inventories	–27,533.6	–29,835.9	+2,302.3
Personnel expenses	–897.5	–877.8	–19.7
Amortization, depreciation, and impairment	–190.7	–199.9	+9.2
Other operating income	24.0	36.3	–12.3
Other operating expenses	–418.5	–374.1	–44.4
Impairment gains (+)/losses (–) on trade receivables	–0.8	0.2	–1.0
Income from investments accounted for using the equity method	34.2	21.8	12.4
Earnings before interest and tax (EBIT)	**523.5**	**302.4**	**+221.1**
Net finance costs	–27.6	–39.4	11.8
Profit before taxes	**495.9**	**263.0**	**+232.9**
Income taxes	–126.6	–72.3	–54.3
Profit after taxes	**369.3**	**190.7**	**178.6**

inventories) – due, in particular, to the increase in revenue excluding precious metals. This gross profit figure rose by 16.3 percent year on year to reach €1,972.8 million.

Personnel expenses went up by €19.7 million to €897.5 million in 2021. This included a year-on-year fall in severance payments to €12.9 million (2020: €28.4 million) and positive currency effects of €6.4 million (2020: positive currency effects of €7.7 million). Adjusted for non-recurring items related to acquisitions, restructuring, and currency, personnel expenses were around 3.5 percent higher than in the previous year.

Amortization, depreciation, and impairment amounted to €190.7 million, a decrease of €9.2 million compared with the previous year. This figure included impairment losses of €27.7 million (2020: €45.2 million). These mainly related to impaired technical equipment that could no longer be used as planned.

Other operating income declined by €12.3 million year on year to €24.0 million, mainly because of a fall in income from the disposal of non-current assets and income received in the previous year from the sale of a product line. Impairment losses on trade receivables amounted to €0.8 million (2020: gains of €0.2 million) because the risk provisioning was more or less unchanged.

Other operating expenses rose by €44.4 million to €418.5 million in the reporting year. The increase was mainly attributable to higher expenses for external services (up by €21.6 million), the additions to provisions for legal costs (up by €16.4 million), and an increase in freight costs (up by €6.0 million).

The contribution from associates to earnings before interest and tax amounted to €34.2 million, an increase of €12.4 million compared with the prior year (2020: €21.8 million). The increase was largely attributable to higher contributions from the associates in Japan and Korea.

Net finance costs amounted to €27.6 million, a substantial improvement of €11.8 million compared with the previous year, primarily because of the reduction in interest expenses for precious metal leases (down by €11.7 million). The main contributing factors were a further decline in the use of precious metal leases for palladium and rhodium in 2021 and falling leasing interest costs for rhodium.

Profit before taxes came to €495.9 million, which was up by €232.9 million on the 2020 figure. The tax rate edged down from 27.5 percent in 2020 to 25.5 percent last year.

Profit after taxes amounted to €369.3 million in 2021 (2020: €190.7 million).

Consolidated balance sheet

€ million	Dec. 31, 2021	Dec. 31, 2020	Change
Non-current assets	3,022.8	1,950.8	+1,072.0
Current assets*	3,970.7	3,963.7	+7.0
Total assets	**6,993.5**	**5,914.5**	**+1,079.0**
Shareholders' equity	3,801.4	3,280.2	+521.2
Non-current liabilities	926.3	959.5	–33.2
Current liabilities*	2,265.8	1,674.8	+591.0
Total shareholders' equity and liabilities	**6,993.5**	**5,914.5**	**+1,079.0**

* The comparative information for 2020 has been restated; see note (2)(b) of the notes to the consolidated financial statements.

The Heraeus Group's financial position was further consolidated in 2021. Heraeus continues to have a very healthy balance sheet, hold a substantial cash balance, and benefit from a secure medium and long-term funding base. At the end of 2021, the Heraeus Group's total assets amounted to €6,993.5 million, a year-on-year increase of €1,079.0 million. Of the total increase, €950.1 million was attributable to acquisitions made in 2021. The Group's equity ratio, at 54.4 percent, was slightly below the previous year's level (2020: 55.5 percent).

Non-current assets rose by €1,072.0 million year on year to reach €3,022.8 million. As a result of the acquisitions, goodwill went up by €346.4 million, other intangible assets by €401.0 million, and property, plant, and equipment by €108.0 million. The company invested €248.4 million in intangible assets and property, plant, and equipment. Amortization, depreciation, and impairment amounted to €190.7 million. Investments accounted for using the equity method increased by €73.1 million, mainly due to further capital contributions and pro rata earnings.

Current assets rose by a total of €7.0 million year on year to reach €3,970.7 million. This includes, in particular, the €148.9 million rise in inventories (excluding precious metals). Some of these increases were offset by a fall of €203.7 million in cash and cash equivalents.

Non-current liabilities went down by €33.2 million compared with the figure as of December 31, 2020 to reach €926.3 million. Pensions and similar obligations fell by €70.6 million year on year, mainly as a result of the increased discount rates. Deferred tax liabilities increased by €29.8 million year on year. Non-current financial debt rose by just a negligible amount to €182.7 million (2020: €181.7 million).

Current liabilities went up by €591.0 million to €2,265.8 million. Current financial debt rose by €511.0 million to €597.5 million, primarily due to the funding of the acquisitions in the reporting year. Liabilities from precious metal swaps rose again by €106.3 million.

The Group funds itself centrally via the Corporate Treasury function at Heraeus Holding GmbH. Liquidity is secured on the basis of multi-year financial planning in which the Group's operational activities are the principal source of liquidity. The Group's sources of medium- and long-term funding are primarily the two directly placed bonds with terms through to 2032 and 2034 and a loan from Germany's KfW development bank with a term through to 2026. To fund its short-term financial requirements, the Group has access to a commercial-paper program and a long-term, committed syndicated loan facility. Neither of these instruments had been utilized at the end of 2021. The Trading units also use precious metal leasing for short-term funding. At the end of 2021, the total market value of the precious metals on loan from third parties amounted to €1,902.0 million (2020: €1,628.0 million).

Net cash provided by operating activities in 2021 came to €607.9 million (2020: €344.9 million). The main contributory factors were profit after taxes of €369.3 million and the non-cash balance from amortization, depreciation, and impairment and reversal of impairment in the amount of €188.8 million. After adjusting for acquisitions and non-cash currency effects, trade payables had fallen year on year by €73.6 million, trade receivables by €56.0 million, and inventories by €34.2 million as of December 31, 2021.

Consolidated cash flow statement

€ million	2021	2020	Change
Net cash provided by operating activities	607.9	344.9	+263.0
Net cash used for investing activities	–1,194.3	–256.9	–937.4
Net cash provided by/used for financing activities	371.6	–107.8	+479.4
Net change in cash and cash equivalents	–214.8	–19.8	–195.0

The net cash used for investing activities of €1,194.3 million mainly comprised payments for acquisitions (€909.4 million), investments in non-current assets (€248.4 million), and payments for the acquisition of other investments (€59.7 million). Interest received of €23.1 million was the main item of cash inflow.

Net cash provided by financing activities of €371.6 million mainly comprised proceeds from the issuing of interest-bearing liabilities (€501.3 million). This was offset by dividends of €46.1 million, interest payments of €42.7 million, and payments relating to the redemption of interest-bearing liabilities in the amount of €40.9 million.

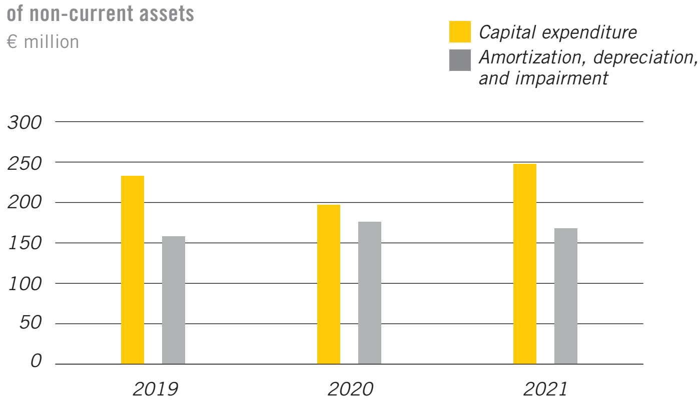
Consequently, there was a decline in cash and cash equivalents of €214.8 million. For further analysis, please refer to the cash flow statement in the notes to the consolidated financial statements.

The Group's liquidity reserves (cash and cash equivalents) amounted to a total of €649.9 million, a year-on-year decrease of €203.7 million that was mostly due to acquisitions. Despite this, the Group's financial position remains very robust, which will enable it to continue to actively develop its businesses and position itself in the market.

Overall, the Group's financial performance in 2021 was very satisfactory. The financial position remains stable and is characterized by a high equity ratio and a robust funding structure as well as a strong cash balance for further capital expenditure on infrastructure and production capacities.

Cash capital expenditure and depreciation, amortization, and impairment of non-current assets

€ million



Capital expenditure and divestments

In 2021, cash additions to property, plant, and equipment and intangible assets totaled €248.4 million (2020: €197.2 million). In addition, there were purchase commitments of €83.2 million at the year-end that could be met using the available cash and cash equivalents.

Further good progress was made last year with the initiatives to modernize and expand the operational sites. Alongside the ongoing projects to expand the Hanau and Kleinostheim sites, other expansion projects – particularly in the USA and Asia – were completed.

In addition to the acquisition of Mo Sci LLC and ETS Wound Care, LLC in the USA, last year Heraeus also acquired 100 percent of the shares in Norwood Medical LLC, a manufacturer of medical instruments, devices, and components based in Dayton, Ohio. The field of activity Industrials was further strengthened by the acquisition of HS Advanced Materials Co., Ltd., in Korea and the purchase of the German company Amorphous Metal Solutions GmbH. The Group also extended its revalyu business by increasing its stake in perPETual Technologies GmbH.

Field of activity Health

Heraeus carries out research on solutions and develops products that contribute to medical progress. The growth in global society and aging demographic structure are driving increasing demand for cutting-edge materials and technologies in the medical sector. Heraeus has a long tradition of involvement in this market; indeed, the business began as a pharmacy. Today, Heraeus is one of the leading manufacturers of orthopedic products, particularly biomaterials. It is also a key supplier in the area of cardiology and minimally invasive surgery.

Business performance

The field of activity Health recovered strongly in 2021, having being severely affected by the coronavirus pandemic in 2020. Revenue excluding precious metals increased by 30.9 percent year on year to reach €458.4 million.

The widespread return to normality in hospitals across Europe and the USA boosted demand in the **biomaterials** business, which resulted in strong revenue growth in 2021. The encouraging performance in this sector is also reflected in the fact that revenue significantly exceeded the figure for 2019 – the last year to be unaffected by the coronavirus pandemic. Three new products were launched in this area last year, providing further positive impetus. In addition to the worldwide introduction of the vacuum mixing system PALAMIX®, which gives surgeons greater flexibility when operating, the single-use cement gun PALAGUN® was launched on the US market in early 2021. The third new product was PALACOS® pro, a new all-in-one fixation system licensed in July 2021 by the FDA (Food & Drug Administration) for use in the USA.

The **medical components and solutions** business also benefited from the global lifting of restrictions on operations, seeing a strong increase in revenue. A number of big-ticket customers in the area of cardiac rhythm management contributed to an encouraging uplift in demand. The business also recorded increased revenue from continuous glucose monitoring (CGM). The acquisitions of previous years also contributed to revenue growth.

Heraeus further expanded its field of activity Health with the acquisition of Norwood Medical LLC in December 2021. This acquisition gives Heraeus access to new markets for the contract manufacturing of medical devices and components, such as minimally invasive surgical instruments, orthopedic devices, and robot-assisted surgery.

Revenue excluding precious metals
Field of activity Health
€ million

Research and development

To counter mounting cost pressures in the healthcare system, the **biomaterials** business is researching cost-efficient solutions that optimize treatment outcomes and help to boost demand for single patient therapy plans. The biomaterials business works in international partnerships in the field of regenerative medicine, including with partners specializing in the area of pharmaceutical preparations for the reactivation of stem cells.

In the **medical components and solutions** business, research into diabetes sensors, neuromodulation leads and solutions, and minimally invasive delivery systems was continued.

Field of activity Electronics

Digitalization and interconnectedness are proceeding apace around the globe and have become a key element of today's society. Heraeus supports customers from the information technology, automotive, telecommunications, and consumer goods industries in making electronic components smaller, longer lasting, and more efficient by offering a broad range of innovative joining and coating technology solutions that are available around the world. Its in-depth materials expertise and its broad technology portfolio allow Heraeus to provide customized and integrated solutions. Heraeus is also a technology leader in the production and processing of high-purity quartz glass. This is the raw material for the production of optical fiber cables for the telecommunications industry and is used to make components for the production of ever smaller semiconductor chips.

Business performance

Performance in the field of activity Electronics was mixed in 2021, with significant variations between the individual aspects of the business. Its revenue excluding precious metals stayed on par with the previous year, at €531.3 million.

Unit sales in the **joining and coating technology** business were very encouraging in 2021. Strong demand in the semiconductor segment in particular, coupled with increased demand in the automotive segment in the first half of 2021, contributed to a strong rise in revenue. In addition to the healthy business development with established products, demand in the metal ceramic substrates portfolio was also encouraging.

Double-digit revenue growth was achieved by the **semiconductor applications** business thanks to high capacity utilization and increased investment activity by the semiconductor industry. The revenue growth was also supported by increased demand in the photonic applications business. The reason for the higher level of demand for photonic applications was the general economic recovery experienced by most of the industries that use these applications.

Although the market for **optical fibers for telecommunications** grew last year as a result of the worldwide expansion of broadband networks with optical fiber cabling to the home (FTTx), Heraeus experienced a slump in revenue in this area. The primary reason for this was that customers in this sector had high levels of inventory at the start of the year that were slowly used up over the course of 2021. In addition, shortages in the supply of raw materials made it more difficult to respond rapidly to the increase in demand in the second half of the year.

Revenue excluding precious metals
Field of activity Electronics
€ million

Research and development

Heraeus is continuously looking for new solutions and products in **joining and coatings technology** that will enable it to continue to meet increasingly challenging customer requirements for cost-efficiency and performance in the future. Special focus areas of research and development in this business include fine pitch solder paste and sinter materials for the sintering of modules on heat sinks. The joining and coatings business is also working on improvements to Die Top System (DTS®), its materials system solution.

A key focus area of research and development activities for the **semiconductor applications** business in 2021 was expanding the product portfolio and processing expertise so that the business could satisfy the ever-increasing customer requirements regarding material properties and purity. With this in mind, even greater efforts were devoted to development activity in the area of synthetic quartz glass and functional materials. The aim of the intensified research and development activity is to be able to offer products that stand out for their even higher levels of precision and purity while also featuring specifically targeted material properties.

The focus of the R&D activity of the **optical fibers for telecommunications** business in 2021 was firmly on new and innovative products and the expansion of the technology portfolio so as to be equipped for the requirements of future generations of fibers.

Field of activity Industrials

Heraeus has long been a partner of choice for industry, based on the Group's in-depth expertise in high-temperature processes and in various sensor applications. Heraeus is a recognized specialist in measurements for molten steel, iron, and aluminum, continuously developing its portfolio of products that ranges from high-performance sensors to complete measuring systems. The field of activity Industrials also includes start-up activities, sensors, and electronic chemicals.

Business performance

Within the field of activity Industrials, revenue excluding precious metals rose by a considerable 8.6 percent in 2021 to reach €690.2 million.

The global recovery in steel production resulted in an increase in demand for sensors and instruments that improve processes at steelworks. A strong upswing in revenue meant Heraeus comfortably exceeded the pre-pandemic level in the **steel business**. The fact that Heraeus is one of the leading manufacturers in the area of integrated measurement systems played a key role here.

The decision to end the production of heaters meant that Heraeus suffered a strong fall in revenue in the **sensors** business. Adjusted for this, however, business performance was encouraging, with double-digit revenue growth in the remaining areas. The broad customer base in the industrial segment was a major contributory factor here. In addition, an unbroken uptrend in demand for sensors used to monitor temperatures in electric motors and in charging equipment continued.

Increasing demand from the automotive and electric-powered vehicles industries for conductive polymers for capacitors meant the **electronic chemicals** business recorded strong revenue growth again. The sustained trend toward digitalization and the worldwide expansion of the 5G network also contributed to last year's success.

Revenue excluding precious metals
Field of activity Industrials
€ million

Research and development

The business involving measurement equipment for high-temperature processes continued to research and develop new products aimed at helping to enhance or improve the safety and efficiency of raw material transformation processes.

In the **sensors** business, Heraeus stepped up the development of 'value-add' sensors that are simpler and easier for customers to use. The business is also developing new resistance-based temperature sensors whose exceptional flexibility and extremely small size open up new fields of application.

In the **electronic chemicals** business, Heraeus continued its research and development projects in collaboration with customers in all segments last year. In particular, it worked on the development of new high-purity materials for the next generation of semiconductors and on solvent-based polymers for use as antistatic additives.

The **start-ups** refocused some of their research priorities during the financial year. In addition to the existing areas of lithium-ion-batteries, amorphous metal alloys, and electromagnetic interference (EMI) shielding, the business is now also involved in new start-up activities related to innovative coating technologies and solutions for the recycling of rare earth elements. Substantial parts of the activity relating to the trading and processing of refractory and precious metals for 3D printing were integrated into the precious metals solutions business.

Field of activity Environmental

The development of sustainable technologies for a clean environment represents one of the key activities at Heraeus. With its photovoltaics products, the company makes a significant contribution to resource-efficient power generation. Another key activity of Heraeus is the manufacturing of specialty light sources to purify water, a resource that is becoming ever scarcer, and air. As a precious metal specialist, the company has extensive expertise in the manufacturing of industrial products containing precious metals for various applications. Heraeus provides services throughout the precious metal cycle, from procurement, through processing, to recycling. Coating and refining processes along with colors and products for the pharmaceutical industry that contain precious metals round off Heraeus' broad expertise in the precious metal cycle and in industrial products in the field of activity Environmental.

Business performance

Revenue excluding precious metals in the field of activity Environmental rose by a strong 10.7 percent year on year to reach €591.8 million.

Following very high demand in the first half of the year, the **silver conductive paste** for solar cells business experienced a significant slump in demand in the second half of the year, resulting in a strong decrease in revenue for the year as a whole. The primary reason for the decline was that many companies scaled back the production of solar cells, due to the high commodity prices for polycrystalline silicon. Power cuts and failures in China caused by supply shortages also significantly limited the production of solar cells.

The **specialty light sources** business benefited last year from economic recovery in the end-customer markets, achieving a strong increase in revenue. Customers in both the automotive segment and the electronics and environmental segment increased their capital expenditure. The establishment of the Soluva® product family for the inactivation of coronaviruses and other pathogens meant that the specialty light sources business was also able to increase the revenue generated from UV disinfection solutions.

As one of the leading suppliers of precious metals services and products, Heraeus reports a strong increase in its revenue from the **precious metal solutions** business again in 2021. The continuing high level of volatility in precious metal prices, combined with strong demand, contributed to the above-average rate of growth. The business benefited in particular from higher customer expectations regarding compliance standards, transparency, and stability, and from its broad customer base.

Revenue excluding precious metals
Field of activity Environmental
€ million

Research and development

The **silver conductive paste** for solar cells business brought new products for cutting-edge manufacturing technologies to market in 2021, such as TOPCon and heterojunction technology (HJT). In addition to the new products, a further area of focus of research was on technologies and materials to increase the efficiency of silver conductive paste.

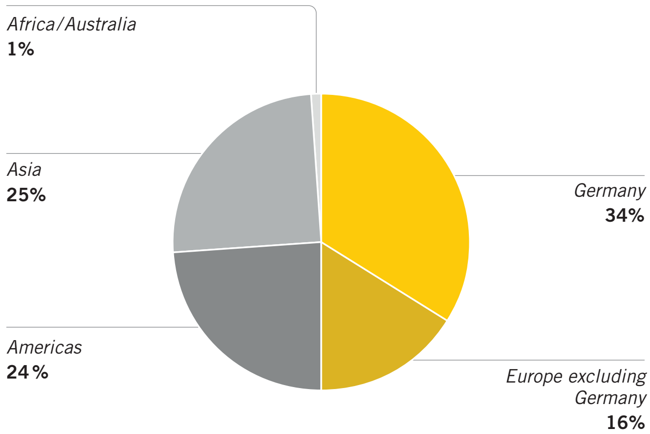
After launching the first generation of the Soluva® product family, the **specialty light sources** business is now working on the second product generation, using the market experience gained form the first generation and making regional adaptations where necessary. The new DryStar Pro LED platform is now being used by key customers. The business is currently developing new products for the use of microwave technology and is conducting research into further optimization of the power density of medium wavelengths.

In 2021, the **precious metal solutions** business conducted research into new catalysis products for hydrogen-fueled transport and active pharmaceutical ingredients based on precious metals and non-precious metals. In addition to these fields of research and development, which will also be pursued in the future, the authentication and traceability of precious metals is a key research area.

People at Heraeus

Number of employees worldwide

Employees by region in 2021



Overview: number of employees

As of December 31, 2021, Heraeus had 15,114 employees worldwide. This was more than the previous year (13,911 employees).

The increase in headcount arose predominantly as a result of a number of international acquisitions and the associated transfer of employees to Heraeus. In September, Heraeus announced the acquisition of Mo Sci LLC, one of the world's leading providers of medical glass and specialty glass, and of ETS Wound Care, LLC, a start-up firm that develops and markets an innovative treatment for chronic wounds based on bioactive glass technology.

Heraeus Conamic acquired Korean company HS Advanced Materials, Co., Ltd. on November 1, 2021. The company processes and sells semi-finished quartz materials such as quartz rings, ingots, plates, rods, and tubes for the semiconductor industry, and uses various important technologies to process quartz glass such as wire saws, band saws, core drilling, lathe cutting, and grinding.

The acquisition of Norwood Medical LLC, a manufacturer of medical instruments, devices, and components, and the transfer of its approximately 1,100 employees in December 2021 played a major part in the increase in the size of the workforce.

The growth-driven expansion of production capacity also created a small number of new jobs.

In order to ensure that the organizational structure is aligned with the portfolio strategy of the Group, some jobs were relocated from the head-office functions to the operational business units. At the same time, there were job cuts in Germany as a result of restructuring measures.

Responsibility: our response to the global coronavirus pandemic

The health and safety of employees and of customers, suppliers, and business partners is always the top priority at Heraeus. Using a clearly defined crisis management process, safety measures and preventive measures are implemented in accordance with national, regional, and local requirements and are communicated to employees via a mobile app. Employees at all sites can find important pandemic-related information here, updated on a daily basis. This comprehensive communication helped to raise the awareness of every individual of the need to act responsibly during this challenging time.

Since the coronavirus vaccination campaign began in May 2021, the Heraeus medical service (HMD) has delivered around 5,000 doses of the vaccine to just under 3,000 Heraeus employees and their family members. The employees are thus playing a major role in health and safety at Heraeus, alongside the protective measures put in place throughout the company.

The new infection control legislation that came into force in November 2021 introduced the '3G' (vaccinated, recovered from infection, or tested) requirement to workplaces in Germany. Inhouse test centers were set up at the company's sites in Hanau, Kleinostheim, Wehrheim, and Bitterfeld. Unfortunately, the pandemic meant that the Heraeus Prevention Days event was unable to take place in the usual format in 2021, with employees attending in person. However, the Heraeus HMD team was able to offer employees an alternative: Digital Health Days. The program included various hands-on activities as well as training videos and information videos.

Outlook

Heraeus anticipates further normalization of its sales markets in 2022, after clear signs of recovery were seen in many market segments in 2021.

The latest figures published by the IMF forecast that the global economy will grow by 4.4 percent in 2022.

In addition to general macroeconomic factors such as rising inflation, the availability of coronavirus vaccines and the vaccination rate of the population will influence the strength of each country's economic recovery in 2022. In the US, the IMF expects the recovery to continue in 2022, as reflected in the growth forecast of 4.0 percent (2021: 5.6 percent). The world's biggest economy is thus predicted to grow only slightly less than China, where growth of 4.8 percent (2021: 8.1 percent) is projected. The recovery within the eurozone is likely to be slightly below the previous year's level, at 3.9 percent (2021: 5.2 percent). For Germany, growth of 3.8 percent (2021: 2.7 percent) is currently forecast, whereas the emerging markets and developing countries including China are set to grow at 4.8 percent (2021: 6.5 percent).

The current growth forecasts remain subject to considerable uncertainty due to the ongoing coronavirus pandemic. The emergence of potential new virus variants and the success of the global vaccination campaigns cannot be reliably predicted, so the possibility of restricted production, supply chain disruption, and supply shortages as a result of measures to contain the pandemic cannot be ruled out for 2022. In addition to regional and national lockdowns, restrictions on the movement of people and goods between countries could affect the forecasts. The economic impact of the war in Ukraine is also extremely difficult to predict, as is the effect of any renewed flare-up of trade disputes between the US and China and the escalation of other geopolitical tensions.

Heraeus anticipates strong growth in revenue excluding precious metals in 2022, and expects all fields of activity to contribute to this to varying degrees. It believes that the semiconductor market will be a key growth driver in 2022 and will thus contribute to positive performance in the relevant Heraeus businesses. In particular, it expects the semiconductor applications business, as a provider of high-performance materials, to benefit from the use of new key technologies in semiconductor manufacturing, such as extreme ultraviolet lithography. Heraeus anticipates that ongoing digitalization and the more widespread use of electric-powered transport will boost demand in the field of activity Electronics. It also expects the field of activity Health to contribute significantly to the growth of the Group. The reason for this, besides the anticipated return to normality of hospital activity around the world, is the acquisition in December of Norwood Medical LLC, headquartered in Dayton, Ohio, USA. In 2022, Heraeus will continue to invest in infrastructure and innovation in order to be able to exploit future sources of revenue growth on a lasting basis.

Profit after taxes in 2022 is projected to decline slightly compared with 2021. This decrease will be mainly due to the anticipated return to normality in precious metal markets in 2022, although the excellence initiatives implemented in past years will continue to have a positive impact. Heraeus does not have any material business relationships with companies in Russia or Ukraine. Revenue generated in these two countries does not make up a significant share of total revenue. The Heraeus Group therefore does not currently expect the war in Ukraine to have any material effect on its profit after taxes, provided that it does not have a major impact on the wider macroeconomic situation.

Heraeus anticipates strong revenue growth for the **field of activity Health** in 2022. The main driver is the expected return to normality of hospital activity worldwide, with COVID-19 patients and other patients being treated in parallel as part of a 'new normal'. On this basis, Heraeus expects demand for biomaterials and medical components and solutions to grow significantly. The expectation that the sustained trends in this sector will contribute to continuous market growth for technologies such as diabetes sensors and neuromodulation leads and solutions, deserves special mention. Moreover, last year's acquisition of Norwood Medical will make a substantial positive contribution to revenue in 2022.

Heraeus projects that revenue will continue to grow strongly in the **field of activity Electronics**. Driven by the ongoing strong trend toward digitalization, Heraeus expects further growth in revenue from semiconductor applications. The current capacity bottlenecks in the semiconductor industry are expected to ease over the course of 2022, which should also have a positive impact. The joining and coating technology solutions business is also expected to make a significant contribution to revenue growth in this field of activity, assisted by the introduction of new products. Heraeus believes that the new products will be particularly relevant with regard to the trend for greater power density and smaller units. In the optical fibers for telecommunications business, Heraeus expects to see customer demand starting to recover in 2022 and a considerable rise in revenue on the back of this. However, the company anticipates volumes and revenue remaining at a low level.

In the **field of activity Industrials**, future business performance is primarily determined by global steel production. Following a rapid bounce-back in production in 2021, the World Steel Association (WSA) predicts a further low rise in demand for steel in 2022. Heraeus therefore expects revenue to remain at the previous year's level in the area of sensors for steel production, but anticipates significantly stronger revenue growth in the sensors and electrochemicals businesses. The sensors business in particular is predicted to benefit from the wider rollout of 'value-add' products and from market-share gains in growing segments such as electric-powered transport. The increased demand for semiconductors is likely to make a significant contribution to revenue growth in the electrochemicals business. In summary, Heraeus expects there to be moderate revenue growth in the field of activity Industrials.

For the **field of activity Environmental**, Heraeus expects a low rise in revenue in 2022, fueled by higher revenue in the precious metal solutions business and, in particular, in the silver conductive paste for solar cells business. Heraeus anticipates a return to normality in cell production, following signs that prices of raw materials for polycrystalline silicon are beginning to fall back to a normal level. Heraeus also expects the specialty light sources business to increase its revenue and be able to benefit from the wider economic recovery in the relevant end-customer markets. The successful implementation of cost-reducing measures in 2021 and the repositioning of the product portfolio should also prove beneficial for the further growth of this business.

Opportunity and risk report

Integrated risk management system

Heraeus operates a Group-wide system of risk management that is used to systematically document and assess risks. The aim is to identify risks at an early stage and to initiate corrective action as appropriate. The material opportunities and risks identified are explained below.

Identified Group-wide material opportunities and risks

The opportunities and risks discussed below are categorized in terms of their potential impact on the Group and presented in declining order within the categories.

Strategic opportunities and risks

Through its portfolio companies, Heraeus operates in virtually all global markets. Most of these markets are subject to rapid technological change. Heraeus manages to stand out from its competitors and offer its customers added value in these markets on the basis of its innovative capabilities. The company maintains close ongoing relationships with academics and researchers in order to build and maintain these innovative capabilities, both now and in the future. These relationships also enable Heraeus to identify and make the most of future strategic opportunities.

The Heraeus Accelerator Program plays a key role in the sharing of knowledge and experience with start-ups. The focus areas of this program in 2021 were 'Precious metals' and 'Advanced packaging for the semiconductor industry'. The R&D activities within the various fields of activity also lay the foundations for the identification of medium to long-term growth potential. Heraeus is increasingly focusing on innovative forms of research collaboration, such as partnerships and corporate venturing, that complement its organic activities so that it can benefit from new developments at an early stage.

Potentially incorrect assessments of customer demand and resulting errors in the product and technology roadmap are a source of strategic risk for Heraeus. This includes risks arising from market trends, particularly of being slow to identify disruptive technologies or failing to spot them at all. The Board of Managing Directors of Heraeus Holding and the relevant bodies within the fields of activity monitor the market closely and regularly monitor the business performance from a strategic perspective in order to limit these risks.

Strategic risks for Heraeus are regarded as low overall.

Market opportunities and risks

Although the sales markets of relevance for Heraeus recovered strongly in 2021, it is difficult to forecast their future development. New coronavirus variants could emerge and it is impossible to predict with any certainty how transmissible they might be or how effective currently available vaccines would be in protecting against them. A further spread of the coronavirus pandemic could mean a severe setback for the company's global sales markets. Economic developments in the Chinese and European markets are especially critical for Heraeus. Heraeus closely monitors economic trends in individual countries and regions in order to be able to react to any negative developments as early as possible. It benefits in this regard from its global market presence, which helps Heraeus to mitigate the impact of regional crises. Economic risk and its effects on business performance constitute a medium risk for the Group due to the global scale of the coronavirus pandemic and the persistently high geopolitical risks.

Heraeus counters threats to its market positions and competitive advantages through its broadly diversified product and customer structures, which help to limit its exposure to individual market risks. In addition, the constant refinement of Heraeus products helps to consolidate the Group's long-term market positioning and protect its competitive edge. Heraeus also minimizes any risks of this nature by building close relationships with customers, steadily adding new big-ticket accounts, and finding and validating additional suppliers for key products. Markets are monitored in detail in each of the fields of activity and alternative products are developed to counter the potential loss of market shares. Heraeus regards the risk to its market position and competitive advantages as low.

Any acceleration in the expansion of the 5G and optical fiber networks would be a source of opportunity for the field of activity Electronics. A more rapid and widespread switch to electric vehicles and increasing demand for semiconductors would have a positive effect on demand in this field of activity.

Heraeus expects the process of market consolidation to continue in the field of activity Health. The Group sees this as an additional opportunity because of its positioning in the relevant markets. However, this opportunity is countered by steadily growing price pressure and tighter regulation as a result of the Medical Devices Regulation introduced in the EU in May 2021.

There may be additional sales opportunities in some end-customer markets in the field of activity Environmental. Demand in the photovoltaics business may rise more strongly than projected, due to increased efforts to achieve climate neutrality, and new regulations may push up demand for disinfection solutions for ballast water in ships. There is also further potential for air purification solutions, as these offer an effective means of removing contaminants from the air, including coronaviruses. However, the possibility of greater competition in some areas of this field of activity cannot be ruled out.

Financial opportunities and risks

As a Group with international operations, Heraeus is exposed to a range of financial risks. These include interest-rate risk, currency risk, credit risk, and liquidity risk.

Processes are in place within Corporate Treasury to identify, quantify, analyze, manage, and monitor these risks, backed up by relevant policies and internal monitoring and control systems.

Currency risk on transactions is mitigated by means of globally diversified procurement, production, and sales activities. Hedges may only be entered into with selected counterparties and only within specified limits. Currency translation risks are not hedged. A standardized global system of receivables management based on a limit system is one of the ways in which Heraeus mitigates credit risk. This is the responsibility of the operating units and is monitored and managed by a central credit management unit. Heraeus can make use of various liquidity safeguarding measures to enable it to respond to short-term as well as unexpected liquidity risk. A sufficient level of cash and cash equivalents as well as agreed lines of credit are among the means it has at its disposal for this purpose.

For a more in-depth analysis of the financial risks, see notes (38) to (42) of the notes to the consolidated financial statements.

Operational opportunities and risks

Avoiding production risks is a key task for Heraeus as a technology group with a broad product portfolio and a large number of sites. Weaknesses in the production process could lead to deliveries being cancelled or delayed, which in turn is associated with the additional risk of contractual penalties. To minimize the impact of disruption to production processes, Heraeus has introduced a business continuity management policy and conducts routine maintenance and servicing of its equipment. Critical production processes are also safeguarded by building a degree of redundancy into the system and holding sufficient back-up inventories. Heraeus has also reduced the risks to business processes that could potentially be caused by individual employees contracting coronavirus through the introduction of strict hygiene protocols, the widespread provision of vaccinations and testing, and the comprehensive use of shift systems and mobile working solutions.

Several risks result from the global procurement process. Fluctuations in the quality of deliveries can lead to substantial risks for Heraeus. Particularly in the medical solutions market, the delivery of base materials and preliminary products, reliable and free of all defects, is very important. Delayed deliveries or disruptions to supply from a supplier could also lead to production bottlenecks or even production downtime. Heraeus mitigates this risk by constantly finding and validating alternative suppliers for key products. Contractual provisions committing suppliers to maintain certain quality and delivery standards and to keep back-up inventories also help to contain risks. This is supported by the global Heraeus purchasing policy, which sets out standardized processes for the procurement of materials, goods, and services from third parties.

In addition to the above, deficiencies in manufacturing processes and resulting defects in product quality represent a risk for Heraeus. Product quality defects could cause reputational damage, cost-intensive rework, product recalls, and, in the worst-case scenario, product liability cases. The most significant risks in this regard are product liability cases involving medical devices and product recalls at automotive suppliers. These risks are mitigated by quality controls and by making continual improvements to the quality management systems. In addition, all businesses are supported by excellence initiatives aimed at achieving maximum product quality.

In summary, Heraeus categorizes the procurement and production risks and the risks associated with quality defects as medium.

The growing interconnectedness of the world has increased the threat posed by cyberattacks and the potential misuse of IT systems. Downtime of key IT systems, the disclosure or loss of integrity of confidential data from research and business operations, and the manipulation of IT systems in process management are particularly relevant risks for Heraeus. Heraeus combats these risks using the latest protection software, network and data encryption, and clear authorization processes specified by the Information

Security Management System (ISMS), which is based on the ISO 27001 international standard. The impact of IT risks and their effect on the financial position and financial performance of the Group is regarded as low.

Operational opportunities are currently available in the form of further efficiency improvements in production processes and an associated reduction of unit costs.

Legal opportunities and risks
Environmental protection and health and safety at work remain key priorities for the Group. Regular campaigns and intensive communications by the global Environment, Health and Safety (EHS) organization help to raise awareness of occupational health and safety throughout the company. Increasingly strict environmental requirements mean there are occasional risks to the unrestricted continued operation of production facilities. Overall, the endangerment of employees or third parties and potential breaches of environmental regulations represent a low source of risk for Heraeus.

It is impossible to completely rule out the possibility of non-compliance with financial and accounting regulations due to the global business activities and the different legal environments in which the company operates. This can also result in customs and tax risks. Heraeus reduces these risks by strictly adhering to central governance policies and continually training staff in the relevant functions. It also operates a central compliance management system in order to further reduce the likelihood of legal infractions or violations of the law. Heraeus also mitigates the risk of fines resulting from potential data protection violations by providing ongoing comprehensive training to make all employees aware of these issues and highlight potential problems. This training is complemented by Group guidelines and policies and the establishment of relevant corporate functions. The use of a largely uniform enterprise resource planning (ERP) system also helps to lower risk by fully integrating and harmonizing relevant business processes. Heraeus considers the overall level of risk to be low.

The growing complexity and number of industrial property rights that need to be observed has increased the risk of possible patent infringements. Despite the measures put in place, such as project-specific searches for property rights, infringements of industrial or intellectual property rights can still occur. Risks from patent infringements are regarded as being low at the current time.

Legal frameworks can also give rise to identifiable opportunities. Heraeus offers a range of products that help customers to meet the requirements of heightened regulations (for example with regard to the purification of water or air or the transition to electricity produced using renewable sources).

External opportunities and risks
Numerous risks are beyond the control of Heraeus. These primarily include force majeure events that might cause damage to German and international locations and risks resulting from country-specific sociocultural and political developments. Heraeus reduces these risks by implementing a rigorous system of business continuity management and through global diversification of its production sites. The risk of damage to the company’s sites is mitigated by taking out insurance. In this context, risks could arise from the continuation of the COVID-19 pandemic. In particular, measures limited to local areas to contain the pandemic, such as lockdowns, could have a negative impact on production operations.

Reputational risk, which can lead to financial losses and also influence other risk categories, is another potential source of negative effects. Based on the measures put in place and the current situation, Heraeus classifies aggregate external risk as medium.

Precious metal trading opportunities and risks
Precious metal trading risks encompass only the risks that arise in connection with business processes involving the trading of precious metals.

The trading companies in Hanau, New York, Hong Kong, and Shanghai are permitted to conduct precious metal transactions solely on the basis of a physical underlying customer transaction. Positions can only be accumulated and held on a daily basis within tightly defined and continuously monitored risk limits. All transactions are recorded and monitored on an ongoing basis in an electronic trading system. All the trading sites use a standardized IT system, which increases transparency and reduces the trading process risks. Heraeus regards precious metal trading risks as being low overall.

Commonly used hedging instruments are employed to hedge price risks. In accordance with the principle of separation of functions, the ongoing monitoring of compliance with prescribed risk limits and thresholds is carried out by employees who do not report to the trading units.

The continuing high level of price volatility in the precious metals markets and a possible increase in demand both from investors in precious metals and from industrial customers are potential sources of opportunity in the precious metal trading business.

Overall risk evaluation

With systems in place for the measurement and limitation of risk, Heraeus is also able to meet the need for early risk detection. Based on an analysis of currently identifiable risks, there are no threats to the continued existence of the Heraeus Group as a going concern.

Compliance report*

The content and structure of the Heraeus compliance system has been continually updated since the introduction of a global Code of Conduct for the Heraeus Group on January 1, 2007. The compliance system has been part of the responsibility management system since 2016. The responsibility office is in charge of compliance and data protection structures and helps to establish and anchor reliable and efficient processes and structures around the world related to the exercise of responsibility.

In 2021, the main focus of the company's compliance activities was on the update of the anti-money laundering policy, the implementation of the EU Conflict Minerals Regulation, preparation for the implementation of the German Supply Chain Due Diligence Act and the German Whistleblower Protection Act (still awaited), and the global rollout of a standard compliance onboarding process for new employees.

As in 2020, particular challenges arose in connection with data protection from the implementation of the requirements arising from the Schrems II judgment by the Court of Justice of the European Union and from the need to ensure, in connection with measures to contain the pandemic, that sensitive personal data was handled in accordance with data protection requirements. Work also continued on developing a strong data protection organization, primarily by means of training and close collaboration with the data protection coordinators appointed in Germany and other EU countries. On November 1, 2021, China introduced its own data protection law that, in many respects, is similar to the EU General Data Protection Regulation in terms of the requirements it places on businesses.

With regard to export controls and customs, assessing the trade dispute between the US and China in order to identify any need for action by the Group companies presented a particular challenge. Progress was made with automation with the aim of achieving greater efficiency and better control, and of optimizing the flow of goods.

For EHS, the main focus in 2021 was on working together to manage the coronavirus pandemic. EHS led the central crisis management team. The unit also worked hard to further reduce the accident rate, particularly with regard to the pressure on the supply chain resulting from shortages of certain materials and supply chain disruptions.

Global training is provided to ensure that all relevant employees have been informed about new regulations and that they know and understand the rules of the Heraeus compliance system. Furthermore, the Heraeus Compliance Officer and the compliance officers in the operating sites regularly share information on compliance matters.

The role of the Group Responsibility Committee, which includes the CEO, the Group General Counsel, the Head of the Responsibility Office, and the heads of key corporate functions, continued to be developed. Once a year, the heads of key corporate functions now inform all heads of units – taking due account of legal structures – about the latest developments relating to compliance.

The Group companies complete an annual compliance questionnaire on the introduction and implementation of compliance guidelines. The completed questionnaires are one of the components used to review the effectiveness of the compliance system.

As well as submitting reports to the Group Responsibility Committee, the Heraeus Compliance Officer formally reports to the CEO once a year.

Based on all the aggregate findings, the Heraeus Compliance Officer and the Group's Board of Managing Directors inform the Supervisory Board's Audit Committee about developments and progress in the compliance management system, as well as about important individual events.

* This section is not included in the auditor's audit content.

Events after the reporting period

At the end of January 2022, Heraeus Medical GmbH and Zimmer Biomet Holdings Inc. achieved a first breakthrough in reaching a mutually acceptable solution in respect of the long-standing legal disputes between the two companies. Heraeus Medical had accused Zimmer Biomet of illegally exploiting its trade secrets. The agreement between the parties includes a payment in the low-triple-digit millions to be made by Zimmer Biomet to Heraeus Medical. In return, all currently pending lawsuits will be ended. On March 3, 2022, the parties signed the final settlement agreement that, among other things, sets out the details of the solution reached, such as payment terms for the settlement amount, the scope of the settled claims, the winding up of the pending legal proceedings, and the future handling of confidential information.

Consolidated financial statements. Total assets increased to €7.0 billion as of the end of the year. Revenue excluding precious metals rose to €2.3 billion. Heraeus more than doubled its profit after taxes to €369.3 million. Earnings before interest and tax (EBIT) jumped to €523.5 million. The number of employees climbed to 15,114 at year-end.

Consolidated balance sheet

of Heraeus Holding GmbH, Hanau, for the year ended December 31, 2021

€ million	Note	Dec. 31, 2021	Dec. 31, 2020*
Goodwill	(10)	500.4	146.1
Other intangible assets	(10)	535.0	154.9
Property, plant, and equipment	(11)	1,517.9	1,271.0
Investments accounted for using the equity method	(12)	244.5	171.4
Other financial assets	(13)	45.7	36.1
Deferred tax assets	(33)	176.6	169.2
Other assets	(14)	2.7	2.1
Non-current assets		**3,022.8**	**1,950.8**
Precious metals	(15)	1,256.0	1,321.2
Inventories – excluding precious metals	(15)	566.1	417.2
Trade receivables	(16)	850.6	833.5
Cash and cash equivalents	(17)	649.9	853.6
Other financial assets	(13)	365.3	320.4
Income tax assets		69.4	65.4
Other assets	(14)	213.4	152.4
Current assets		**3,970.7**	**3,963.7**
Assets		**6,993.5**	**5,914.5**

€ million	Note	Dec. 31, 2021	Dec. 31, 2020*
Subscribed capital		210.0	210.0
Capital reserve		127.8	127.8
Retained earnings		3,300.5	2,907.3
Other reserves		140.8	19.0
Treasury shares		–8.2	–8.2
Equity attributable to the shareholders of Heraeus Holding GmbH	**(18)**	**3,770.9**	**3,255.9**
Non-controlling interests	(19)	30.5	24.3
Shareholders' equity		**3,801.4**	**3,280.2**
Pensions and similar obligations	(21)	566.0	636.6
Provisions	(22)	46.0	54.9
Financial debt	(23)	182.7	181.7
Other financial liabilities	(24)	11.0	5.8
Deferred tax liabilities	(33)	105.4	75.6
Other liabilities	(25)	15.2	4.9
Non-current liabilities		**926.3**	**959.5**
Provisions	(22)	156.3	152.1
Financial debt	(23)	597.5	86.5
Trade payables	(26)	400.5	453.5
Other financial liabilities	(24)	598.8	481.9
Income tax liabilities		27.3	31.0
Other liabilities	(25)	485.4	469.8
Current liabilities		**2,265.8**	**1,674.8**
Shareholders' equity and liabilities		**6,993.5**	**5,914.5**

* Prior-year figures restated, see (2)(b)

Consolidated income statement

of Heraeus Holding GmbH, Hanau, for the period January 1 to December 31, 2021

€ million	Note	2021	2020
Revenue	(27)	29,506.4	31,531.8
Change in inventories		37.8	–6.3
Cost of materials		–27,571.4	–29,829.6
Personnel expenses	(28)	–897.5	–877.8
Amortization, depreciation, and impairment	(29)	–190.7	–199.9
Other operating income	(30)	24.0	36.3
Other operating expenses	(31)	–418.5	–374.1
Impairment gains (+)/losses (–) on trade receivables	(16)	–0.8	0.2
Income from investments accounted for using the equity method	(12)	34.2	21.8
Earnings before interest and tax (EBIT)		**523.5**	**302.4**
Finance income	(32)	23.8	21.0
Finance costs	(32)	–51.4	–60.4
Net finance costs		**–27.6**	**–39.4**
Profit before taxes		**495.9**	**263.0**
Income taxes	(33)	–126.6	–72.3
Profit after taxes		**369.3**	**190.7**
thereof attributable to the shareholders of Heraeus Holding GmbH		*360.9*	*183.1*
thereof attributable to non-controlling interests	*(19)*	*8.4*	*7.6*

Consolidated statement of comprehensive income

of Heraeus Holding GmbH, Hanau, for the period January 1 to December 31, 2021

€ million	Note	2021 Amount before taxes	2021 Tax expense/income	2021 Amount after taxes	2020 Amount before taxes	2020 Tax expense/income	2020 Amount after taxes
Profit after taxes		**495.9**	**–126.6**	**369.3**	**263.0**	**–72.3**	**190.7**
Items that will not be reclassified to profit or loss							
Remeasurement of net liability arising from defined benefit pension plans	(21)	69.3	3.9	73.2	–49.5	–8.5	–58.0
Items that have been or can be reclassified to profit or loss							
Currency translation adjustment		130.3	–	130.3	–86.9	–	–86.9
Currency translation adjustment reclassified to profit or loss		–	–	–	–0.6	–	–0.6
Share of other comprehensive income of investments accounted for using the equity method		–1.2	–	–1.2	–7.2	–	–7.2
Effective portion of changes in fair value of cash flow hedges	(39a)	–4.1	1.3	–2.8	2.2	–0.7	1.5
Cash flow hedges reclassified to profit or loss	(39a)	–2.2	0.7	–1.5	–1.2	0.4	–0.8
Other comprehensive income		**192.1**	**5.9**	**198.0**	**–143.2**	**–8.8**	**–152.0**
Total comprehensive income		**688.0**	**–120.7**	**567.3**	**119.8**	**–81.1**	**38.7**
thereof attributable to the shareholders of Heraeus Holding GmbH				*555.9*			*31.7*
thereof attributable to non-controlling interests				*11.4*			*7.0*

Consolidated cash flow statement

of Heraeus Holding GmbH, Hanau, for the period January 1 to December 31, 2021

€ million	Note	2021	2020*
Profit after taxes		**369.3**	**190.7**
Amortization, depreciation, impairment, and reversal of impairment of non-current assets	(10) (11)	188.8	199.4
Net finance costs	(32)	27.6	39.4
Distributions received from associates and joint ventures		11.4	11.6
Change in inventories		34.2	–229.9
Change in trade receivables		56.0	–60.3
Change in trade payables		–73.6	89.8
Change in provisions and in pensions and similar obligations		–31.4	–18.9
Change in other net assets		–23.5	107.7
Other non-cash transactions and other non-operating expenses		45.4	19.1
Gains on disposal of property, plant, and equipment		3.7	–3.7
Net cash provided by operating activities	**(34)**	**607.9**	**344.9**
Proceeds from the disposal of non-current assets		1.8	8.8
Proceeds from the disposal of other business units		–	9.3
Payments for investments in non-current assets		–248.4	–197.2
Payments for business combinations minus acquired liquid funds		–909.4	–76.9
Payments for the acquisition of other investments		–59.7	–14.1
Payments for loans to associates		–1.7	–7.4
Interest received		23.1	20.6
Net cash used for investing activities	**(35)**	**–1,194.3**	**–256.9**
Distributions, including distributions to non-controlling interests		–46.1	–43.5
Payments for share repurchases	(18)	–	–8.2
Interest paid		–42.7	–54.0
Proceeds from the issuing of interest-bearing liabilities		501.3	27.9
Payments relating to the redemption of interest-bearing liabilities		–40.9	–30.0
Net cash provided by/used for financing activities	**(36)**	**371.6**	**–107.8**
Net change in cash and cash equivalents		**–214.8**	**–19.8**
Effect of exchange rate differences on cash and cash equivalents		11.1	–9.2
Cash and cash equivalents at the beginning of the period		853.6	882.6
Cash and cash equivalents at the end of the period	**(37)**	**649.9**	**853.6**

* Prior-year figures restated, see (2)(b)

Consolidated statement of changes in shareholders' equity

of Heraeus Holding GmbH, Hanau, for the period January 1 to December 31, 2021

				Retained earnings		Other reserves					
€ million	Note	Subscribed capital	Capital reserve	Other retained earnings	Remeasurement of defined benefit pension plans	Currency translation	Cash flow hedges	Treasury shares	Equity attributable to the shareholders of Heraeus Holding GmbH	Non-controlling interests (19)	Shareholders' equity
Shareholders' equity as of Jan. 1, 2020		**210.0**	**127.8**	**3,053.3**	**–231.2**	**111.6**	**0.8**	**–**	**3,272.3**	**20.9**	**3,293.2**
Profit after taxes, 2020		–	–	183.1	–	–	–	–	183.1	7.6	190.7
Remeasurements of defined benefit pension plans	(21)	–	–	–	–58.0	–	–	–	–58.0	–	–58.0
Currency translation		–	–	–	–	–86.9	–	–	–86.9	–0.6	–87.5
Share of income from investments accounted for using the equity method		–	–	–	–	–7.2	–	–	–7.2	–	–7.2
Cash flow hedges	(39a)	–	–	–	–	–	0.7	–	0.7	–	0.7
Other comprehensive income for 2020		**–**	**–**	**–**	**–58.0**	**–94.1**	**0.7**	**–**	**–151.4**	**–0.6**	**–152.0**
Total comprehensive income for 2020		**–**	**–**	**183.1**	**–58.0**	**–94.1**	**0.7**	**–**	**31.7**	**7.0**	**38.7**
Distributions	(36)	–	–	–39.9	–	–	–	–	–39.9	–3.6	–43.5
Other changes	(18)	–	–	–	–	–	–	–8.2	–8.2	–	–8.2
Shareholders' equity as of Dec. 31, 2020		**210.0**	**127.8**	**3,196.5**	**–289.2**	**17.5**	**1.5**	**–8.2**	**3,255.9**	**24.3**	**3,280.2**
Shareholders' equity as of Jan. 1, 2021		**210.0**	**127.8**	**3,196.5**	**–289.2**	**17.5**	**1.5**	**–8.2**	**3,255.9**	**24.3**	**3,280.2**
Profit after taxes, 2021		–	–	360.9	–	–	–	–	360.9	8.4	369.3
Remeasurements of defined benefit pension plans	(21)	–	–	–	73.2	–	–	–	73.2	–	73.2
Currency translation		–	–	–	–	127.3	–	–	127.3	3.0	130.3
Share of income from investments accounted for using the equity method		–	–	–	–	–1.2	–	–	–1.2	–	–1.2
Cash flow hedges	(39a)	–	–	–	–	–	–4.3	–	–4.3	–	–4.3
Other comprehensive income for 2021		**–**	**–**	**–**	**73.2**	**126.1**	**–4.3**	**–**	**195.0**	**3.0**	**198.0**
Total comprehensive income for 2021		**–**	**–**	**360.9**	**73.2**	**126.1**	**–4.3**	**–**	**555.9**	**11.4**	**567.3**
Distributions	(36)	–	–	–40.9	–	–	–	–	–40.9	–5.2	–46.1
Shareholders' equity as of Dec. 31, 2021		**210.0**	**127.8**	**3,516.5**	**–216.0**	**143.6**	**–2.8**	**–8.2**	**3,770.9**	**30.5**	**3,801.4**

Notes to the consolidated financial statements

of Heraeus Holding GmbH, Hanau, for the year ended December 31, 2021

Significant accounting policies

1 General disclosures

Heraeus Holding GmbH is the Group's parent company and its headquarters are at Heraeusstrasse 12–14, 63450 Hanau, Germany. The company is registered in the commercial register of the Hanau local court under the number HRB 3364. Heraeus Holding GmbH is a family-owned global technology group that, on the basis of its range of products, is one of the leading providers in each of its global sales markets. These include the markets for electronics, medical equipment, semiconductors, telecommunications, lighting, chemicals, pharmaceuticals, steel, photovoltaics, and automotive products.

Applying section 315e of the German Commercial Code (HGB), the consolidated financial statements of Heraeus Holding GmbH have been prepared in accordance with International Financial Reporting Standards (IFRS) as adopted by the European Union (EU). All of the IFRS, International Accounting Standards (IAS), and interpretations of the IFRS Interpretations Committee (IFRS IC) that were required to be applied in the 2021 financial year were followed. In addition to the IFRS requirements, all statutory disclosure and explanation requirements in the HGB were met.

The 2021 financial year of Heraeus Holding GmbH began on January 1, 2021 and ended on December 31, 2021. The corresponding prior-year period was January 1, 2020 to December 31, 2020. The consolidated financial statements have been prepared in euros. Unless otherwise stated, all amounts are shown in millions of euros (€ million).

To improve the clarity of presentation and the transparency of the consolidated financial statements, some items on the consolidated balance sheet and in the consolidated income statement have been aggregated and are reported separately in the notes to the consolidated financial statements. The consolidated income statement has been prepared using the nature-of-expense method. The assets and liabilities on the balance sheet are broken down into current and non-current items. Assets and liabilities are considered to be current if they fall due or are intended to be sold within one year or within the entity's normal operating cycle. This period begins with the procurement of the resources needed for the production process and ends with the receipt of cash or cash equivalents in return for the sale of the products created or services provided in this process. Trade receivables, trade payables, and inventories are reported as current items. Deferred tax assets, deferred tax liabilities, and pensions and similar obligations are reported as non-current items.

The consolidated financial statements are generally prepared using the cost method, with the exception of derivative financial instruments, investments, and certain other financial assets and liabilities, which are measured at fair value.

On March 10, 2022, the consolidated financial statements of Heraeus Holding GmbH for the financial year from January 1, 2021 to December 31, 2021 were released by the Board of Managing Directors and forwarded to the Supervisory Board for approval.

2 Amendments to accounting policies

(a) Initial application of new standards and interpretations

Amendments to standards that are of relevance to Heraeus and were applied for the first time in the reporting year are explained below. Various other amendments have been issued as well, but these are not expected to be of relevance to the consolidated financial statements of Heraeus.

Amendments to IFRS 16 – 'COVID-19-Related Rent Concessions':
IFRS 16 sets out rules for the presentation of changes to lease payments (for example, rent concessions) in the lessee's accounts. The lessee generally has to review for each individual lease whether the rent concessions granted constitute a lease modification and has to perform any resulting remeasurements of lease liabilities.

The amendment to IFRS 16 provides the option to use a practical expedient. However, this practical expedient is time-limited and tied to certain conditions. It allows the lessee to report COVID-19-related rent concessions as if no lease modification had occurred rather than requiring application of the normal rules for lease modifications.

There was no material impact on the consolidated financial statements.

(b) Changes in presentation
Claims and liabilities arising from certain purchases of recycling materials were previously netted on the balance sheet until the precious metal price was fixed. Since the 2021 financial year, they have been presented on a gross basis (see also (6f)). As part of this, advances paid for recycling materials were netted with liabilities for outstanding invoices. The prior-year figures have been restated accordingly.

The impact on the consolidated balance sheet was as follows:

€ million	Dec. 31, 2021	Change	Dec. 31, 2021 restated	Dec. 31, 2020	Change	Dec. 31, 2020 restated
Precious metals	1,107.5	148.5	1,256.0	1,028.4	292.8	1,321.2
Other assets	248.6	–35.2	213.4	296.0	–143.6	152.4
Trade payables	–287.2	–113.3	–400.5	–304.3	–149.2	–453.5

In the consolidated cash flow statement, there were minor changes to certain positions within net cash provided by operating activities. Overall it was unchanged.

3 Financial reporting standards not applied early

Heraeus does not plan to apply the following new or amended standards and interpretations before the mandatory application date. Their application is only mandatory in subsequent annual periods. Other new standards, interpretations, and amendments have also been issued, but they are not expected to impact on the consolidated financial statements of Heraeus.

(a) Already endorsed by the EU
Amendments to IFRS 16 – 'COVID-19-Related Rent Concessions beyond 30 June 2021':
In response to the ongoing impact of the coronavirus pandemic, IFRS 16 'Leases' was amended on March 31, 2021 in order to extend, by one year, the practical expedient that makes it easier for lessees to account for COVID-19-related rent concessions. The amendments extend the practical expedient to rent concessions that reduce lease payments that were originally due on or before June 30, 2022. Previously, the practical expedient covered only rent concessions that reduced lease payments due on or before June 30, 2021.

The amendments come into force for annual reporting periods commencing on or after April 1, 2021. Earlier application is permitted.

The Group currently anticipates that there will be no material impact on the consolidated financial statements.

Amendments to IAS 37 – 'Onerous Contracts – Cost of Fulfilling a Contract'
The amendments affect the definition of the costs that a company should include when assessing whether a contract is onerous. Under this definition, the cost of fulfilling a contract comprises all costs that relate directly to the contract. This includes costs that would not be incurred if the contract had not been concluded (incremental costs) and other costs that are directly attributable to the contract.

The amendments come into force for reporting periods commencing on or after January 1, 2022. Early application of the amendments is permitted.

The Group currently anticipates that there will be no material impact on the consolidated financial statements.

IFRS 17 – 'Insurance Contracts'
IFRS 17 supersedes IFRS 4 and establishes for the first time standardized principles for the recognition, measurement, presentation, and disclosure in the notes of insurance contracts, reinsurance treaties, and investment contracts with discretionary participation features. Under the IFRS 17 measurement model, groups of insurance contracts are measured on the basis of the expected value of discounted cash flows, including an explicit risk adjustment for non-financial risk and a contractual service margin that will lead to a profit that the entity will recognize as it provides services under the insurance contracts in the group.

The amendments come into force for reporting periods commencing on or after January 1, 2023. Early application of the amendments is permitted.

The Group currently anticipates that there will be no material impact on the consolidated financial statements.

Amendments to IAS 1 and IFRS Practice Statement 2 – 'Disclosure of Accounting Policies'
The amendment to IAS 1 stipulates that only 'material' accounting policies should be disclosed in the notes. To be classed as material, the accounting policy must relate to material transactions or other events and there must be a reason for its disclosure. Examples of such reasons are that the policy has changed, that the policy was chosen from a range of options, that the policy is complex or requires the entity to make significant accounting estimates, or that the policy was developed in accordance with IAS 8.10-11. Accordingly, the amendments to Practice Statement 2 show how the concept of materiality is to be applied to the disclosure of accounting policies. In the future, the focus should be on entity-specific information rather than on standardized information.

The amendments come into force for reporting periods commencing on or after January 1, 2023. Early application of the amendments is permitted.

The Group currently anticipates that there will be no material impact on the consolidated financial statements.

Amendments to IAS 8 – 'Definition of Accounting Estimates'
The amendment to IAS 8 clarifies how entities can distinguish more clearly between accounting policy changes and accounting estimate changes. To this end, it specifies that an accounting estimate always relates to a monetary amount in the financial statements that is subject to measurement uncertainty. To calculate an accounting estimate, an entity uses not only inputs but also measurement methods. Measurement methods can be estimation methods or measurement techniques.

The amendments come into force for reporting periods commencing on or after January 1, 2023. Early application of the amendments is permitted.

The Group currently anticipates that there will be no material impact on the consolidated financial statements.

(b) Not yet endorsed by the EU

Amendments to IAS 12 – 'Deferred Tax related to Assets and Liabilities arising from a Single Transaction'

The amendments address previous uncertainties about how to account for deferred taxes in relation to leases, disposal obligations, and restoration obligations.

When assets and liabilities are recognized for the first time, an initial recognition exemption applies provided that certain requirements are met (IAS 12.15). As an exception in such cases, deferred taxes do not have to be recognized. In practice, however, there was uncertainty about whether this exemption also applied to leases, disposal obligations, and restoration obligations. A narrow-scope amendment to IAS 12 has now been made in order to ensure that the standard is applied consistently.

As a result of this amendment, the initial recognition exemption no longer applies to transactions that, on initial recognition, give rise to equal amounts of deductible and taxable temporary differences, even if the other previously applicable requirements are met. In other words, the initial recognition exemption has been withdrawn for a narrowly defined set of cases. The amendment means that deferred taxes on, for example, leases recognized by a lessee or on disposal obligations or restoration obligations, have to be recognized.

The amendments come into force for reporting periods commencing on or after January 1, 2023, subject to incorporation into EU law. Early adoption is permitted, subject to endorsement by the EU.

The Group currently anticipates that there will be no impact on the consolidated financial statements.

4 Principles of consolidation

The financial statements of the consolidated entities have been prepared as of the balance sheet date of the consolidated financial statements in accordance with uniform accounting policies that comply with IFRS.

As part of acquisition accounting, the carrying amounts of equity investments in subsidiaries are offset against the portion of equity held in these subsidiaries. In the case of business combinations, the identified assets and liabilities acquired are recognized at fair value. Certain items, such as deferred taxes and employee benefits, are measured in accordance with the standards pertinent to them. Any excess of the purchase price over the fair value of net assets acquired after allocation of the purchase price is recognized as goodwill. A negative excess is recognized in the income statement in the period in which the acquisition takes place. Non-controlling interests are measured as of their acquisition date and recognized in proportion with the share of the identified net assets of the acquiree that they hold.

Income and expenses arising from intercompany transactions are eliminated in full. Profits and losses from intercompany sales and services are eliminated. Receivables and liabilities within the Group are offset against each other. The income tax implications of consolidation transactions that are recognized in the income statement are taken into account and deferred taxes are recognized.

5 Currency translation

Separate financial statements prepared in foreign currencies by subsidiaries abroad are translated into euros as the presentation currency. Because subsidiaries conduct their business independently from a financial, commercial, and organizational perspective, their functional currency is generally the same as their local currency. For eight foreign subsidiaries (2020: six), the functional currency is the US dollar or euro rather than their local currency.

In the consolidated financial statements, income and expenses arising from financial statements prepared in foreign currencies are translated at the average exchange rate for the year, assets and liabilities are translated at the closing rate, and shareholders' equity is translated at historical rates. Any remaining exchange differences are reported in other comprehensive income.

Exchange differences arising from the consolidation of receivables and liabilities are recognized in profit or loss and reported in other operating income or other operating expenses in the consolidated income statement. Foreign-currency receivables and liabilities reported in local subsidiaries' separate financial statements are translated at the closing rate. Unrealized gains and losses on the balance sheet date are recognized in profit or loss.

Exchange rate gains and losses from the translation of operating receivables and liabilities in foreign currency and net gains or losses from the fair value measurement of derivatives used as operating hedges for underlying transactions in foreign currency are reported in other operating income or other operating expenses. Net exchange rate gains or losses in connection with funding are reported in net finance costs.

The table below shows changes in the exchange rates against the euro used to translate major currencies:

		Closing rate		Average rate	
	€1 =	Dec. 31, 2021	Dec. 31, 2020	2021	2020
China	CNY	7.1947	8.0225	7.6282	7.8747
UK	GBP	0.8403	0.8990	0.8596	0.8897
Hong Kong	HKD	8.8333	9.5142	9.1932	8.8587
Japan	JPY	130.38	126.49	129.88	121.85
Canada	CAD	1.4393	1.5633	1.4826	1.5300
South Korea	KRW	1,346.38	1,336.00	1,354.06	1,345.58
Switzerland	CHF	1.0331	1.0802	1.0811	1.0705
USA	USD	1.1326	1.2271	1.1827	1.1422

6 Accounting policies

(a) Goodwill

Capitalized goodwill is tested for impairment on an annual basis or whenever there are indications of impairment. Impairment testing is generally based on value in use. Fair value less costs of disposal is only calculated if the value in use of a cash-generating unit falls below its carrying value and it is possible to make a reliable estimate. As soon as goodwill is impaired in full, it is treated as a disposal in the consolidated statement of changes in non-current assets.

(b) Other intangible assets

Intangible assets that have been purchased are carried at cost and amortized using the straight-line method over their useful life, provided they have a finite useful life. The main intangible assets relate to customer relationships, technologies, and brands stemming from acquisitions. They are predominantly amortized over a period of between seven and 15 years, while a useful life of three to five years is used for software.

When accounting for internally generated intangible assets, a distinction is made between research costs and development costs. Research costs are recognized as expenses in the consolidated income statement as incurred, while development costs for future products or technologies are capitalized, provided they meet all of the relevant criteria on a cumulative basis. If they do not meet the criteria for capitalization, costs are recognized in profit or loss for the year in which they are incurred.

(c) Property, plant, and equipment

Property, plant, and equipment is measured at cost less cumulative depreciation and impairment. Cost comprises the purchase consideration and any directly attributable purchase-related costs incurred to bring an asset into the working condition required for its intended use.

Grants, allowances, and similar government assistance are deducted from cost.

Property, plant, and equipment is depreciated over its useful economic life using the straight-line method. Depreciation is generally based on the following useful lives:

Asset item	Useful life (years)
Buildings	15–50
Leasehold improvements	5–25
Plant and machinery	10–25
Office furniture and equipment	4–25

(d) Leases

As a lessee, the Group recognizes assets for the rights to use the leased assets and liabilities for obligations entered into to make payments. The right-of-use assets are recognized at cost initially and then depreciated on a straight-line basis over the term of the lease. The cost of the right-of-use asset is the present value of all future lease payments plus any lease payments made at or before the lease commencement date, the direct costs for performance of the lease, and the estimated costs for dismantling, removing, or restoring the leased asset. Right-of-use assets are recognized under property, plant, and equipment. Lease liabilities are initially recognized at the present value of the outstanding lease payments and subsequently accounted for using the effective interest method. The discount rate applied is generally the lessee’s incremental borrowing rate of interest. Lease liabilities are recognized under non-current or current financial debt depending on their residual term.

The recognition exemption is applied for leases where the underlying asset has a low value. The payments under these leases are instead recognized as an expense on a straight-line basis.

(e) Joint ventures and associates

Investments in joint ventures and associates are measured at the relevant proportion of equity using the equity method. If these entities have different balance sheet dates, interim financial statements are used for them.

(f) Precious metals

For measurement purposes, precious metal inventories are divided into the following categories:

The unhedged precious metal inventory, consisting of precious metals tied up in processing and production processes and precious metals held for strategic reasons, is measured at the lower of weighted average cost and net realizable value. If the reasons for recognizing a write-down cease to exist, it is reversed up to a maximum of original cost.

The inventory held on demand is the stock of precious metals needed to fulfill customer orders. Precious metals for the inventory held on demand are measured at the contractual purchase price agreed for the customer (attributable cost of purchase).

The trading inventory consists of precious metals that are held by the trading companies in the Group. It is generally recognized at contracted cost of purchase. Obligations to cover forward purchases already entered into that are due to be settled after the balance sheet date are recognized in the amount required to meet the obligations as of the balance sheet date. They are shown under other liabilities.

The refining stock owned (see also (2b)) consists of recycling materials containing precious metals that are already owned by Heraeus but have not yet been processed. The precious metal purchase prices for these materials have not yet been fixed, so the estimated quantities are measured at the precious metal prices valid as of the balance sheet date. A related liability for outstanding invoices is recognized under trade payables. The final value of the recycling materials is determined after the precious metal purchase prices have been fixed.

(g) Inventories – excluding precious metals

Materials and supplies, commodities, work in progress, and finished goods are measured at the lower of cost and net realizable value. The cost of materials and supplies is generally determined on the basis of weighted average costs; the cost of work in progress and finished goods is, in some cases, also based on standard costs if these are close to the market value. Write-downs of inventories are recognized if the net realizable value is lower than the recognized cost.

(h) Financial instruments

Measurement and classification

Financial instruments include non-derivative financial instruments such as trade receivables, trade payables, financial debt, and other financial assets and liabilities. There are also derivative financial instruments, which are used to hedge currency, price, and interest-rate risk.

The following categories of financial assets are relevant to Heraeus in the context of debt instruments:
- measured at amortized cost,
- measured at fair value through profit or loss.

Classification is based on the business model used to manage debt instruments and on the characteristics of the contractual cash flows.

Debt instruments are measured at amortized cost if they are held as part of a business model aimed at collecting contractual cash flows and the contractual terms give rise on specified dates to cash flows that are solely payments of principal and interest on the principal amount outstanding.

Debt instruments that are not measured at amortized cost are measured within the Group at fair value through profit or loss.

For equity instruments that are not held for trading purposes and are otherwise measured at fair value through profit or loss, there is an option to recognize the fair value changes in other comprehensive income. In this case, amounts recognized in other comprehensive income cannot be reclassified to profit or loss at a later date. This option is considered on a case-by-case basis for each instrument; the decision on exercising the option is irrevocable.

Financial liabilities are classified into the following categories:
- measured at amortized cost,
- measured at fair value through profit or loss.

Regular way purchases and sales of financial instruments are recognized at their settlement date, while derivatives are recognized at their trade date. Initial measurement is at fair value.

Impairment

Impairment losses are recognized in the amount of the expected credit loss for debt instruments that are measured at amortized cost. At each balance sheet date, they are adjusted to reflect the change in credit risk of the financial instrument in question since initial recognition and, as a rule, are based on the lifetime expected credit losses.

At each balance sheet date, an assessment is carried out to ascertain whether there has been a significant increase in credit risk. The individual credit risk is assessed using quantitative and qualitative information, such as data on credit default swaps, past experience, and assumptions about the future. The latter include industry-specific and country-specific expectations regarding future credit risk.

Indications of a significant increase in credit risk include, among others, the following information and expectations:
- a significant change in the external or internal credit rating of the financial instrument,
- unfavorable changes to the business situation, financial parameters, or economic conditions that have a significant influence on the credit standing of the customer in question,
- evidence that a customer is in significant financial difficulties, or
- non-compliance with payment terms.

In 2021, no significant need to recognize impairment losses on credit balances with banks or other debt instruments was identified.

By contrast, expected credit losses on trade receivables are calculated using a simplified model based on a provision matrix.

Derivative financial instruments

Derivatives are measured at fair value.

Commodity futures to which the own-use exemption pursuant to IFRS 9 does not apply are separated from the own-use portfolio and recognized at fair value as held for trading. Changes in fair value are recognized in profit or loss.

In individual cases, hedge accounting is applied to the hedging of predicted future cash flows in foreign currencies and to the hedging of interest payments (cash flow hedges).

At the inception of hedge accounting, the hedging relationship between the underlying transaction and the hedging instrument is documented, including the risk-management objectives and the corporate strategy behind entering into hedges. A record is also kept of whether the designated hedging instrument is highly effective, in terms of the risk that is being hedged, in compensating for changes in the fair value of the underlying transaction or in the cash flows arising from the underlying transaction. This is carried out when hedges are taken out as well as during their term.

The effective part of changes in the fair value of hedging instruments is recognized in other comprehensive income, taking deferred taxes into account. Only at the time that the corresponding gains or losses on the underlying transaction are realized are the cumulative adjustments to equity recognized in profit or loss.

Trade receivables

Trade receivables are measured at amortized cost. They are generally due within one year, so discounting is not necessary.

A simplified method is used to measure the expected credit loss on trade receivables. Under this method, the impairment loss is calculated using a provision matrix with defined time periods and taking country-specific and industry-specific characteristics into account. The default of credit-impaired trade receivables is examined separately on a case-by-case basis.

Indications that trade receivables may be credit-impaired include, but are not limited to:
- The customer is in significant financial difficulty,
- The contract is breached due to payment becoming past due, or
- The customer is faced with the threat of insolvency.

Impairment losses are recognized in profit or loss. If it becomes apparent in subsequent periods that the reasons for recognizing an impairment loss no longer apply, the impairment loss is reversed up to a maximum of the original cost.

Carrying amounts of receivables are adjusted via an allowance account. Receivables that are uncollectible are derecognized by writing them off in full.

The impairment loss, the income from the reversal, and other changes recognized in profit or loss resulting from the adjustment of measurement parameters are presented on a net basis in a separate line in the consolidated income statement.

Cash and cash equivalents

Cash and cash equivalents are reported at amortized cost. Cash on hand in foreign currency is translated at the closing rate. The money market funds included are not subject to significant fluctuations in value and can be converted to cash within one day.

Financial debt

Financial debt relates to registered bonds, liabilities to banks, and lease liabilities. It is recognized at amortized cost using the effective interest method.

Other financial assets and other financial liabilities

Other financial assets and liabilities are predominantly measured at amortized cost. There is a small volume of equity instruments that, depending on whether the option has been exercised, are measured at fair value through profit or loss or at fair value through other comprehensive income. There are also derivatives that are measured at fair value.

In order to manage precious metal liquidity, Heraeus concludes precious metal swaps with its counterparties. Amounts paid or received in relation to these transactions are reported under Other financial assets or Other financial liabilities.

(i) Pensions and similar obligations

Defined benefit obligations are recognized and measured separately for each defined benefit plan using the projected unit credit method, which takes into account expected increases in salaries and pensions in the future in addition to the pensions and vested pension rights known at the balance sheet date. The actuarial assumptions regarding discount rates, increases in salaries and pensions, staff turnover, and rises in healthcare costs on which the calculation of the defined benefit obligation is based are determined for each country taking into account the economic conditions in each case. The interest rates used to discount defined benefit obligations are based on market yields on high-quality bonds denominated in the same currency and for the same duration as the defined benefit obligations.

If defined benefit obligations are funded by assets held by a legally independent entity that may only be used to meet the pension obligations incurred, and are beyond the reach of any creditors, the assets are deducted from the defined benefit obligations, which are recognized as a net liability. The funds held by the Heraeus Group's German companies and some of its companies abroad qualify as plan assets and are therefore offset against the present value of the defined benefit obligations.

The actuarial gains and losses that arise from changes in the assumptions underlying the calculations, and from variations between those assumptions and actual developments, are recognized in the Group's other comprehensive income in the period that they arise, taking account of deferred taxes. They are shown in a separate reserve within retained earnings. If the defined benefit obligations are sold or redeemed, they are reclassified to other retained earnings.

The expenses for defined contribution plans attributable to each year are recognized directly in personnel expenses in that year.

(j) Provisions

Provisions are recognized when the Group has a current legal or constructive obligation to a third party as the result of a past event, an outflow of resources is probable, and the amount of the obligation can be reliably estimated. Provisions are recognized in the amount of the most likely settlement amount, or if there is a large number of possible scenarios, in the amount of the expected value of the possible settlement amounts. Estimates are reviewed and adjusted periodically.

If the time value of money is material, provisions that will not result in an outflow of resources until after the following year are recognized at the present value of the expenditure estimated to be needed to meet the obligation.

(k) Deferred taxes
Deferred taxes are calculated on the basis of temporary differences between the carrying amounts of assets and liabilities in the IFRS financial statements and the Group's tax accounts, realizable loss carryforwards, and consolidation transactions. They are calculated using the tax rates anticipated in the various countries at the time these items are recognized, based on the legal provisions in force or approved at the balance sheet date.

Deferred taxes based on items not recognized in profit or loss are likewise not recognized in profit or loss. In line with their underlying transactions, they are either recognized in other comprehensive income or taken directly to equity.

Deferred tax assets are offset against deferred tax liabilities if levied by the same taxation authority and if there is a legally enforceable right to offset current tax assets against current tax liabilities.

Deferred tax assets are recognized if it is likely that future taxable profits will be available against which it will be possible to offset deductible temporary differences, unutilized tax losses, and unutilized tax credits.

(l) Revenue and other income
Revenue is reported in the amount of the consideration that Heraeus expects to receive and recognize when the customer obtains control over the agreed goods and services and can benefit from them. Control may pass at a certain point in time or over a period of time. The performance obligations arising under contracts with customers of Heraeus are predominantly fulfilled at a point in time. In trading transactions, control routinely passes with effect from the due date; in recycling transactions, this takes place on the day that the customer is reimbursed.

Revenue is recognized over a period of time only in a small number of cases and to an immaterial extent. As a rule, the period between fulfillment of the performance obligation and payment is not material. The contracts do not typically include a funding component.

The total proceeds from services included in revenue are insignificant. Interest income is recognized pro rata in accordance with the effective interest method; this includes interest for the leasing of precious metals.

Contract assets and contract liabilities may arise in certain cases and are shown under other assets and other liabilities respectively.

(m) Cost of materials
Cost of materials includes the costs of raw materials and supplies, goods, and precious metals.

(n) Impairment of intangible assets and property, plant, and equipment
Intangible assets and property, plant, and equipment are tested for impairment if there are indications of impairment. If the carrying amount is above the recoverable amount, impairment losses are recognized. The recoverable amount is the higher of fair value less costs of disposal and value in use.

If the reasons for recognizing impairment losses cease to apply, impairment losses are reversed. The reversal recognized in profit or loss is limited to the lower of the recoverable amount and the depreciated/amortized carrying amount that would have arisen had no impairment loss been recognized in the past. Goodwill is excluded from the reversal of impairment losses.

Impairment losses and reversals thereof are reviewed at the level of the cash-generating unit unless the recoverable amount can be determined for the individual asset.

7 Use of key accounting estimates and judgments

Preparation of the consolidated financial statements in accordance with IFRS requires accounting estimates to be used and judgments made that have an impact on the amounts reported for, and the recognition of, assets, liabilities, income, and expenses.

The material assumptions and parameters for the accounting estimates that have been made are based on the information and data available at the time and are reviewed on an ongoing basis. Changes to accounting estimates are made prospectively.

The likely impact of the coronavirus pandemic was estimated in particular for the purposes of determining impairment losses on trade receivables ('expected credit loss model') and testing goodwill for impairment. Based on the assumptions made in this context, the coronavirus pandemic is still not expected to have any material impact on the financial position and financial performance of Heraeus.

(a) Assumptions and estimation uncertainties

Business combinations (see (9)): Determination of the fair value of the consideration transferred (including contingent consideration) and determination of the fair value of the identifiable assets acquired and liabilities assumed.

Intangible assets (see (10)): Impairment test – material assumptions on which the calculation of the recoverable amount is based.

Trade receivables (see (16)): Calculation of the expected default – default rates for the different time periods.

Pensions and similar obligations (see (21)): Measurement of defined benefit obligations – material actuarial assumptions.

Provisions (see (22)): Recognition and measurement of provisions – material assumptions about the probability and extent of the outflow of resources.

Deferred tax assets/liabilities (see (33)): Availability of future taxable profits against which deferred tax assets can be utilized.

(b) Judgements

Investments accounted for using the equity method (see (12)): Decisions about whether an investment might be deemed not to be controlled by Heraeus, despite Heraeus holding a majority of voting rights.

8 Scope of consolidation

In addition to Heraeus Holding GmbH, the consolidated financial statements include subsidiaries over which Heraeus Holding GmbH exercises control.

The following table shows the breakdown of consolidated entities:

Consolidated subsidiaries

	2021			2020		
	Total	In Germany	Outside Germany	Total	In Germany	Outside Germany
Balance as of Jan. 1	**111**	**28**	**83**	**112**	**29**	**83**
Additions	11	1	10	3	1	2
Disposals	–1	–	–1	–2	–	–2
Mergers	–1	–	–1	–2	–2	–
Balance as of Dec. 31	**120**	**29**	**91**	**111**	**28**	**83**

The financial year of the consolidated subsidiaries is the calendar year.

Joint ventures and associates included in the consolidated financial statements using the equity method

	2021			2020		
	Total	In Germany	Outside Germany	Total	In Germany	Outside Germany
Balance as of Jan. 1	**8**	**1**	**7**	**7**	**–**	**7**
Additions	–	–	–	1	1	–
Balance as of Dec. 31	**8**	**1**	**7**	**8**	**1**	**7**

9 Business combinations

(a) Business combinations in 2021

The following acquisitions took place in the reporting year:

	Type of acquisition	Voting rights acquired (%)	Date of acquisition
Start-ups			
Amorphous Metal Solutions GmbH, Germany	Share deal	100.0	June 30, 2021
Mo Sci LLC, USA and ETS Wound Care, LLC, USA	Share deal	100.0	December 21, 2021
Heraeus Conamic			
HS Advanced Materials, Co., Ltd., South Korea	Share deal	100.0	November 1, 2021
Norwood Medical			
Norwood Medical LLC, USA	Share deal	100.0	December 14, 2021

The total consideration transferred came to €925.3 million (of which €922.1 million in cash).

Mo Sci and ETS

The acquisition of Mo Sci and ETS extends Heraeus' medical technology portfolio.

Mo Sci is one of the world's leading providers of medical and specialty glass. It develops specialty glass and ceramic products for specific market applications. Today, Mo Sci is a leading provider of glass microspheres, fibers, and powders for the medical technology sector. It also provides sealing glass and test services for the aerospace, automotive, and electronics industries.

ETS was founded in order to develop and commercialize an innovative borate-based bioactive glass technology platform for wound care and hemostasis. ETS has received clearance from the U.S. Food and Drug Administration (FDA) for its first product, Mirragen, a resorbable synthetic skin substitute. It is working on expanding the technology to new applications.

The purchase consideration for Mo Sci and ETS came to US$ 68.1 million or €60.1 million. Of this total, US$ 3.6 million or €3.2 million related to expected earn-out payments, which depend on future revenue and could be incurred in the period up to and including 2030. The earn-out component was calculated using a Monte Carlo simulation. The cash portion of the purchase consideration was hedged using a currency forward.

The following amounts were recognized for the assets and liabilities of the acquired companies as of the acquisition date:

€ million	
Non-current assets	**36.0**
Other intangible assets	27.8
Property, plant, and equipment	5.9
Deferred tax assets	0.7
Other financial assets	1.6
Current assets	**7.4**
Inventories – excluding precious metals	1.3
Trade receivables	1.5
Cash and cash equivalents	0.8
Other financial assets	3.8
Assets acquired	**43.4**
Non-current liabilities	**3.8**
Other financial liabilities	3.8
Current liabilities	**2.1**
Trade payables	0.2
Other financial liabilities	1.6
Other liabilities	0.3
Liabilities acquired	**5.9**
Net assets acquired	**37.5**

After purchase price allocation, goodwill amounted to €22.6 million, all of which is tax-deductible. This figure mainly represents synergies arising from the expansion of the product and service profile and is based on the technological expertise in relation to specialty glass and medical technology.

The fair value of the acquired trade receivables is not materially different from the amount of gross receivables.

Because the acquisition took place shortly before the balance sheet date, the fair values of the intangible assets were measured on a provisional basis until a full independent measurement can be conducted.

From the acquisition date, consolidated revenue for 2021 included revenue of €0.1 million generated by the acquired companies; the contribution to earnings from the acquisitions amounted to a loss of €1.1 million.

The hypothetical impact of the acquisition on revenue, assuming consolidation from the beginning of the year, would have been an increase of €15.5 million, and the impact on profit after taxes would have been a decrease of €3.1 million.

Norwood Medical

The acquisition of Norwood Medical significantly expands Heraeus' global presence in the healthcare sector. Norwood Medical, based in Dayton, Ohio, USA, is a leading full-service provider of advanced medical manufacturing solutions for minimally invasive surgical instruments, robot-assisted surgery, and orthopedic markets. Norwood Medical gives Heraeus access to new markets for the contract manufacturing of medical devices and components, such as minimally invasive surgical instruments, orthopedic devices, and robot-assisted surgery.

The purchase consideration for Norwood Medical came to US$ 983.6 million or €851.9 million and was entirely from cash. The purchase consideration was hedged using a currency forward.

The following amounts were recognized for the assets and liabilities of the acquired company as of the acquisition date:

€ million	
Non-current assets	**469.9**
Other intangible assets	361.3
Property, plant, and equipment	101.5
Deferred tax assets	7.1
Current assets	**98.1**
Inventories – excluding precious metals	65.5
Trade receivables	15.2
Cash and cash equivalents	17.4
Assets acquired	**568.0**
Current liabilities	**39.8**
Financial debt	3.2
Trade payables	2.9
Other financial liabilities	17.3
Other liabilities	16.4
Liabilities acquired	**39.8**
Net assets acquired	**528.2**

After purchase price allocation, goodwill amounted to €323.7 million, all of which is tax-deductible. This figure mainly represents planned value creation measures and the expansion of the product and service portfolio.

The fair value of the acquired trade receivables is not materially different from the amount of gross receivables.

Because the acquisition took place shortly before the balance sheet date, the fair values of the intangible assets, property, plant, and equipment, and inventories were measured on a provisional basis until a full independent measurement can be conducted.

From the acquisition date, consolidated revenue for 2021 included revenue of €7.1 million generated by the acquired company; the contribution to earnings from the acquisition amounted to a loss of €4.1 million.

The hypothetical impact of the acquisition on revenue, assuming consolidation from the beginning of the year, would have been an increase of €160.5 million, and the impact on profit after taxes would have been a decrease of €17.2 million.

(b) Business combinations in 2020

The following acquisitions took place in the previous year:

	Type of acquisition	Voting rights acquired (%)	Date of acquisition
Heraeus Medical Components			
Contract Medical International GmbH, Germany	Share deal	100.0	January 31, 2020
Pulse Systems, LLC, USA	Share deal	100.0	October 30, 2020

The total purchase consideration amounted to €82.4 million, of which €79.3 million had impacted on cash as of December 31, 2020.

Notes to the consolidated balance sheet

10 Intangible assets

a) Goodwill

Goodwill increased from €146.1 million as of December 31, 2020 to €500.4 million at the end of the financial year. The change arose from additions of €346.8 million in connection with acquisitions and from valuation gains of €7.5 million resulting from higher exchange rates.

Goodwill is usually monitored at global business unit level. With the exception of the goodwill arising on the acquisition of Norwood Medical LLC (see (9)), none of this goodwill was material when considered individually. Because the acquisitions of Norwood and Mo Sci/ETS took place shortly before the balance sheet date, the precise allocation of the goodwill arising on these acquisitions is currently being reviewed.

The goodwill was tested for impairment on the basis of the value in use and a five-year planning period; the gross margin was the most important key assumption in this context. The discount rates before taxes ranged from 9.0 percent to 11.3 percent (2020: 10.3 percent to 11.8 percent) and the rates of growth in perpetuity from 0 percent to 2 percent (2020: 0 percent to 2 percent).

As in 2020, no impairment losses on goodwill were recognized in the reporting year. A realistic potential change to the key assumptions would not have led to any impairment either.

The coronavirus situation is constantly evolving and forecasts made in the 2021 financial year regarding the duration and scale of the pandemic's impact on cash flows are therefore subject to considerable uncertainty. Heraeus has made any underlying estimates and assumptions on the basis of the best information available at the time and a scenario which assumes that the economic impact of the current pandemic will not persist in the long term.

Goodwill was allocated to the global business units as follows:

€ million	Dec. 31, 2021	Dec. 31, 2020
Heraeus Medical Components	59.2	55.1
Norwood Medical	322.3	–
Heraeus Electronics	13.7	13.2
Heraeus Electro-Nite	25.9	24.0
Heraeus Nexensos	0.5	0.4
Start-ups	22.6	–
Heraeus Precious Metals	26.2	25.2
Heraeus Noblelight	30.0	28.2
Goodwill	**500.4**	**146.1**

b) Other intangible assets

€ million	Goodwill	Customer relationships, technologies, brands, licenses, and similar rights	Internally generated intangible assets	Total
Jan. 1, 2020				
Cost	124.6	524.8	4.0	653.4
Accumulated amortization and impairment	–7.6	–372.9	–2.8	–383.3
Net carrying amount	117.0	151.9	1.2	270.1
Financial year ended Dec. 31, 2020				
Net carrying amount as of Jan. 1, 2020	117.0	151.9	1.2	270.1
Exchange differences	–7.0	–5.6	–	–12.6
Additions through business combinations	36.1	36.0	–	72.1
Additions	–	1.7	1.0	2.7
Disposals	–	–1.1	–	–1.1
Reclassifications	–	1.5	–	1.5
Amortization expense	–	–25.2	–0.4	–25.6
Impairment losses	–	–6.1	–	–6.1
Net carrying amount as of Dec. 31, 2020	**146.1**	**153.1**	**1.8**	**301.0**
Dec. 31, 2020 / Jan. 1, 2021				
Cost	153.3	527.2	5.0	685.5
Accumulated amortization and impairment	–7.2	–374.1	–3.2	–384.5
Net carrying amount	146.1	153.1	1.8	301.0
Financial year ended Dec. 31, 2021				
Net carrying amount as of Jan. 1, 2021	146.1	153.1	1.8	301.0
Exchange differences	7.5	4.0	–	11.5
Additions through business combinations	346.8	400.7	0.3	747.8
Additions	–	1.4	0.3	1.7
Reclassifications	–	0.5	0.3	0.8
Amortization expense	–	–26.8	–0.6	–27.4
Net carrying amount as of Dec. 31, 2021	**500.4**	**532.9**	**2.1**	**1,035.4**
Dec. 31, 2021				
Cost	507.6	951.4	6.1	1,465.1
Accumulated amortization and impairment	–7.2	–418.5	–4.0	–429.7
Net carrying amount	500.4	532.9	2.1	1,035.4

Research and development costs amounting to €138.4 million (2020: €142.6 million) were recognized in the consolidated income statement.

The impairment losses recognized in 2020 related to technologies and customer relationships. Impairment losses are reported in the consolidated income statement under the item ‘Amortization, depreciation, and impairment’.

11 Property, plant, and equipment

€ million	Dec. 31, 2021	Dec. 31, 2020
Property, plant, and equipment excluding right-of-use assets	1,403.5	1,189.6
Right-of-use assets	114.4	81.4
Property, plant, and equipment	**1,517.9**	**1,271.0**

a) Property, plant, and equipment (excluding right-of-use assets)

€ million	Land, land rights and buildings, including buildings on land owned by others	Plant and machinery	Office furniture and equipment	Assets under construction	Total
Jan. 1, 2020					
Cost	761.0	1,080.6	634.6	206.5	2,682.7
Accumulated depreciation and impairment	–373.1	–689.8	–442.5	–10.9	–1,516.3
Net carrying amount	387.9	390.8	192.1	195.6	1,166.4
Financial year ended Dec. 31, 2020					
Net carrying amount as of Jan. 1, 2020	387.9	390.8	192.1	195.6	1,166.4
Exchange differences	–7.5	–10.4	–2.7	–3.7	–24.3
Additions through business combinations	–	4.1	1.7	0.3	6.1
Additions	4.4	31.5	16.5	142.1	194.5
Disposals	–1.3	–3.3	–2.0	–0.8	–7.4
Reclassifications	16.2	53.4	24.3	–95.5	–1.6
Depreciation expense	–17.5	–55.3	–32.7	–	–105.5
Impairment losses	–	–8.4	–6.0	–24.7	–39.1
Reversals of impairment losses	–	0.4	0.1	–	0.5
Net carrying amount as of Dec. 31, 2020	**382.2**	**402.8**	**191.3**	**213.3**	**1,189.6**
Dec. 31, 2020 / Jan. 1, 2021					
Cost	748.7	1,110.8	656.0	240.8	2,756.3
Accumulated depreciation and impairment	–366.5	–708.0	–464.7	–27.5	–1,566.7
Net carrying amount	382.2	402.8	191.3	213.3	1,189.6
Financial year ended Dec. 31, 2021					
Net carrying amount as of Jan. 1, 2021	382.2	402.8	191.3	213.3	1,189.6
Exchange differences	11.3	12.9	4.2	5.7	34.1
Additions through business combinations	3.9	72.3	1.5	0.1	77.8
Additions	25.3	20.4	19.4	181.6	246.7
Disposals	–2.6	–1.2	–1.6	–0.1	–5.5
Reclassifications	39.7	48.4	24.9	–113.8	–0.8
Depreciation expense	–17.7	–60.7	–34.2	–	–112.6
Impairment losses	–0.2	–20.7	–5.1	–1.7	–27.7
Reversals of impairment losses	–	1.6	0.3	–	1.9
Net carrying amount as of Dec. 31, 2021	**441.9**	**475.8**	**200.7**	**285.1**	**1,403.5**
Dec. 31, 2021					
Cost	819.8	1,358.9	693.5	314.2	3,186.4
Accumulated depreciation and impairment	–377.9	–883.1	–492.8	–29.1	–1,782.9
Net carrying amount	441.9	475.8	200.7	285.1	1,403.5

The impairment losses of €13.9 million (2020: €24.2 million) recognized on property, plant, and equipment mainly relate to the Bitterfeld site and its activities in the field of optical fibers for telecommunications technology. Delays in the expansion of the 5G infrastructure and growing competition mean that capacities in this area cannot be fully utilized. Further impairment losses are attributable to various businesses and sites around the world.

As in 2020, the impaired assets largely included facilities that were no longer found to be recoverable or that could no longer be used as originally intended. The assets involved were written off in full because they have no significant fair value and no material benefit can be obtained by continuing to use them. As in 2020, the impairment losses were reported in the consolidated income statement under the item ‘Amortization, depreciation, and impairment’.

(b) Right-of-use assets

The right-of-use assets mainly relate to rented properties outside Germany.

The following table shows a breakdown of the net carrying amount of the right-of-use assets and the depreciation on right-of-use assets by asset class:

	Net carrying amounts		Depreciation	
€ million	Dec. 31, 2021	Dec. 31, 2020	2021	2020
Land, land rights and buildings, including buildings on land owned by others	102.4	67.5	–15.7	–15.2
Plant and machinery	1.2	1.4	–0.3	–0.7
Office furniture and equipment	10.8	12.5	–7.0	–7.7
Right-of-use assets	**114.4**	**81.4**	**–23.0**	**–23.6**

Additions to right-of-use assets amounted to €53.4 million in the reporting year (2020: €33.4 million), of which €30.2 million (2020: €6.4 million) was attributable to acquisitions.

Further details on leasing can be found in the following sections:
- Impairment on right-of-use assets: see (29)
- Expenses for leases where the underlying asset has a low value: see (31)
- Interest expenses on lease liabilities: see (32)
- Total cash outflow for leases: see (36)

12 Investments accounted for using the equity method

The table below shows the aggregated financial information for the joint ventures and associates that are included in the Heraeus consolidated financial statements using the equity method:

€ million	Shin-Etsu Quartz Products Co., Ltd.	perPETual Technologies GmbH	Non-material equity-accounted entities: Joint ventures	Non-material equity-accounted entities: Associates	Total for equity -accounted entities
Amounts as of Dec. 31, 2021					
Carrying amount of investment	108.2	62.3	28.2	45.8	244.5
Proportionate gain	17.5	1.3	8.6	6.8	34.2
Amounts as of Dec. 31, 2020					
Carrying amount of investment	101.4	10.4	23.0	36.6	171.4
Proportionate gain	9.5	0.0	4.8	7.5	21.8

Joint venture: Shin-Etsu Quartz Products Co., Ltd.

The operating activities of Shin-Etsu Quartz Products Co., Ltd., based in Tokyo, Japan, include the manufacture, sale and trading of quartz glass and associated products.

The table below shows a summary of the financial information for Shin-Etsu Quartz Products Co., Ltd.:

€ million	Dec. 31, 2021	Dec. 31, 2020
Share in percent	**50.0**	**50.0**
Non-current assets	67.6	72.1
Current assets	226.0	201.1
thereof cash and cash equivalents	*119.7*	*85.0*
Non-current liabilities	14.7	14.4
thereof financial liabilities excluding trade payables and other liabilities	–	–
Current liabilities	62.5	56.0
thereof financial liabilities excluding trade payables and other liabilities	–	–
Net assets (100%)	216.4	202.8
Share of net assets	108.2	101.4
Carrying amount of investment in joint venture	**108.2**	**101.4**

€ million	2021	2020
Distributions received	7.4	8.4
Revenue	194.1	176.5
Profit after taxes / total comprehensive income	35.0	19.0
Group’s share in profit after taxes / total comprehensive income	**17.5**	**9.5**

Joint venture: perPETual Technologies GmbH

The operating activities of perPETual Technologies GmbH, a global specialist in PET recycling based in Kleinostheim, Germany, include the recycling of used PET bottles to produce PET ester that is then processed to create high-quality filament yarns for use in sustainable fabric. The company was acquired with effect from November 30, 2020. The stake held in this company was increased from 33.75 percent to 53.38 percent in 2021. As all key decisions can only be made together with the other shareholder, Heraeus does not have control over perPETual despite holding the majority of voting rights.

The table below shows a summary of the financial information for perPETual Technologies GmbH:

€ million	Dec. 31, 2021	Dec. 31, 2020
Share in percent	**53.38**	**33.75**
Non-current assets	69.4	34.8
Current assets	62.1	12.2
thereof cash and cash equivalents	*55.0*	*6.6*
Non-current liabilities	13.0	14.9
thereof financial liabilities excluding trade payables and other liabilities	*13.0*	*14.9*
Current liabilities	1.8	1.3
thereof financial liabilities excluding trade payables and other liabilities	–	*0.3*
Net assets (100%)	116.7	30.8
Share of net assets	62.3	10.4
Carrying amount of investment in joint venture	**62.3**	**10.4**

€ million	2021	2020
Distributions received	–	–
Revenue	16.9	–
Profit after taxes / total comprehensive income	2.5	–
Group's share in profit after taxes / total comprehensive income	**1.3**	**–**

13 Other financial assets

Other financial assets comprise the following items:

€ million	Dec. 31, 2021			Dec. 31, 2020		
	Current	Non-current	Total	Current	Non-current	Total
Receivables from precious metal swaps	318.5	–	318.5	239.7	–	239.7
Financial assets	–	37.0	37.0	–	25.1	25.1
Derivatives with positive fair value	23.6	0.2	23.8	54.7	5.1	59.8
Lease receivables	1.3	3.3	4.6	1.2	4.2	5.4
Margin accounts	6.8	–	6.8	14.1	–	14.1
Miscellaneous financial assets	15.1	5.2	20.3	10.7	1.7	12.4
Other financial assets	**365.3**	**45.7**	**411.0**	**320.4**	**36.1**	**356.5**

Margin accounts represent cash amounts that are pledged as collateral for futures transactions. The pledges expire when the collateralized transactions are settled.

14 Other assets

Other assets are broken down as follows:

€ million	Dec. 31, 2021			Dec. 31, 2020*		
	Current	Non-current	Total	Current	Non-current	Total
Other tax receivables	124.8	2.3	127.1	69.4	1.3	70.7
Advances paid	17.0	0.1	17.1	20.0	0.1	20.1
Contract assets	7.4	–	7.4	3.4	–	3.4
Miscellaneous non-financial assets	64.2	0.3	64.5	59.6	0.7	60.3
Other assets	**213.4**	**2.7**	**216.1**	**152.4**	**2.1**	**154.5**

* Prior-year figures restated, see (2)(b)

15 Inventories

The table below gives a breakdown of inventories:

€ million	Dec. 31, 2021	Dec. 31, 2020*
Materials and supplies	245.1	197.1
Work in progress, finished goods, and merchandise	396.7	287.1
Write-downs of inventories – excluding precious metals	–75.7	–67.0
Inventories – excluding precious metals	**566.1**	**417.2**
Precious metals	1,268.4	1,338.6
Write-downs of precious metals	–12.4	–17.4
Precious metals	**1,256.0**	**1,321.2**
Inventories	**1,822.1**	**1,738.4**

* Prior-year figures restated, see (2)(b)

Impairment losses of €9.9 million (2020: €19.0 million) were recognized on inventories excluding precious metals in 2021. Reversals of write-downs on inventories excluding precious metals amounted to €6.4 million in 2021 (2020: €3.6 million). As in 2020, no material write-downs or reversals of write-downs were recognized on precious metals.

16 Trade receivables

The breakdown of trade receivables is as follows:

€ million	Dec. 31, 2021	Dec. 31, 2020
Gross trade receivables	721.7	664.2
Impairment losses	–34.6	–32.4
Net trade receivables	**687.1**	**631.8**
Assets arising from bills of exchange	163.5	201.7
Trade receivables	**850.6**	**833.5**

Default risk is taken into account by the recognition of appropriate impairment losses. Risk-specific default rates are determined on the basis of historical default data. This process takes account of forward-looking macroeconomic indicators and duly considers the economic impact of the coronavirus crisis. The default rates determined in this way were not materially higher than in 2020.

Assets arising from bills of exchange are guaranteed by banks. The credit risk is currently regarded as not material.

The table below shows changes in impairment losses recognized on gross trade receivables:

€ million	2021	2020
Impairment losses as of Jan. 1	**–32.4**	**–34.9**
Currency translation	–2.1	0.7
Additions	–6.3	–4.8
Utilization	0.7	1.6
Reversals	5.5	5.0
Impairment losses as of Dec. 31	**–34.6**	**–32.4**

The impairment loss of €0.8 million that was recognized in the consolidated income statement (2020: gain of €0.2 million) represents the net balance of additions and reversals.

The following table presents the provision matrix for 2021:

	Term to maturity as of December 31, 2021					
€ million	Not due	less than 30 days	between 30 and 90 days	between 91 and 180 days	more than 180 days	Total
Gross trade receivables	523.1	112.4	22.9	30.9	32.4	721.7
Weighted average default rate	0.1 %	0.1 %	5.7 %	17.2 %	84.9 %	
Impairment losses	–0.4	–0.1	–1.3	–5.3	–27.5	–34.6
Net receivables	**522.7**	**112.3**	**21.6**	**25.6**	**4.9**	**687.1**

The provision matrix for the previous year can be presented as follows:

€ million	Term to maturity as of December 31, 2020					
	Not due	less than 30 days	between 30 and 90 days	between 91 and 180 days	more than 180 days	Total
Gross trade receivables	534.8	69.1	25.6	6.1	28.6	664.2
Weighted average default rate	0.2 %	1.0 %	5.5 %	54.1 %	91.3 %	
Impairment losses	–0.9	–0.7	–1.4	–3.3	–26.1	–32.4
Net receivables	**533.9**	**68.4**	**24.2**	**2.8**	**2.5**	**631.8**

17 Cash and cash equivalents

Cash and cash equivalents comprise the following items:

€ million	Dec. 31, 2021	Dec. 31, 2020
Credit balances with banks, cash on hand, and other cash	588.7	704.1
Short-term deposits	61.2	149.5
Cash and cash equivalents	**649.9**	**853.6**

18 Equity attributable to the shareholders of Heraeus Holding GmbH

The subscribed capital is the maximum amount for which the shareholders of Heraeus Holding GmbH are liable in respect of the company's liabilities to creditors.

Retained earnings include the profits generated by Heraeus Holding GmbH and the subsidiaries included in the consolidated financial statements that have not been distributed. The line item also includes income from joint ventures and associates accounted for using the equity method, consolidation transactions recognized in profit or loss, and the effects of offsetting actuarial gains and losses arising from pensions and similar obligations, net of deferred taxes, against equity.

Other reserves comprise currency translation adjustments and the effects of the measurement of hedging transactions, taking deferred taxes into account. The gains and losses reported in the cash flow hedge reserve are reclassified to the consolidated income statement when the corresponding gains and losses from the hedged item are recognized through profit or loss.

In 2020, treasury shares worth €8.2 million had been purchased and deducted from the shareholders' equity.

The Board of Managing Directors of Heraeus Holding GmbH have proposed a dividend distribution of €45.1 million (2020: €40.9 million) for the 2021 financial year.

19 Non-controlling interests

Shares held by minority interests in the shareholders' equity of consolidated companies are reported under non-controlling interests.

The profits attributable to these shareholders in 2021 were €8.4 million (2020: €7.6 million). As in 2020, no losses were attributable to non-controlling interests.

20 Capital management disclosures

The objective of capital management is to ensure financial flexibility in order to secure the continued existence of the company as a going concern over the long term, further develop the business portfolio, and enable the company to seize strategic opportunities. The target capital structure is defined by the competent decision-making bodies, taking due consideration of selected key financials such as the debt level and the equity ratio.

As of the balance sheet date, the capital structure was as follows:

€ million	Dec. 31, 2021	Dec. 31, 2020	Change (%)
Shareholders' equity	**3,801.4**	**3,280.2**	**15.9**
Percentage of total shareholders' equity and liabilities	83.0	92.4	
Current financial debt	597.5	86.5	
Non-current financial debt	182.7	181.7	
Financial debt	**780.2**	**268.2**	**190.9**
Percentage of total shareholders' equity and liabilities	17.0	7.6	
Total shareholders' equity and liabilities (shareholders' equity plus financial debt)	**4,581.6**	**3,548.4**	**29.1**

Access to a broad range of financial instruments is deemed a crucial aspect of financial flexibility. In this context, Heraeus uses the capital markets for both public placements to institutional investors and private placements. It also makes use of the bank market via a broadly diversified group of major international banks.

The funding strategy is reflected in the credit ratings awarded by the rating agencies Moody's and Standard & Poor's.

The following table provides an overview of the corporate ratings of Heraeus:

	Dec. 31, 2021		Dec. 31, 2020	
	Moody's Investors Service	**Standard & Poor's**	**Moody's Investors Service**	**Standard & Poor's**
Non-current financial debt	Baa1	BBB+	Baa1	BBB+
Current financial debt	-	A-2	-	A-2
Outlook	stable	stable	negative	stable

21 Pensions and similar obligations

Under the company pension scheme, employees of companies included in the consolidated financial accounts have entitlements to defined benefit and defined contribution pension schemes. Defined benefit pension schemes encompass both current pensions and entitlements to future pensions. The benefits paid by the Group usually depend on employees' years of service and earnings and are governed by different pension scheme rules. At Heraeus, defined benefit pension schemes are funded by way of both provisions and investment funds. The main pension arrangements are described below.

The payment obligations are predominantly attributable to German companies and relate to pension plans providing retirement benefits, invalidity benefits, and benefits paid to surviving dependants. These obligations are based, on the one hand, on defined benefit pension schemes with benefits based on length of service and final salary. These schemes have been closed to new members. On the other hand, employees who joined after January 1, 1988 have a direct pension entitlement under an employer-funded, contribution-based scheme that is not linked to final salary. The entitlement arises from the accumulation of pension components determined annually that are calculated on the basis of a defined pension expense and an age-related pension annuitization schedule. Since 2001, employees have also had the option of purchasing additional pension benefits by voluntarily converting remuneration into pension components that go toward a contribution-based scheme.

The contribution-based direct pension entitlements are each covered by investments in securities funds. Since their introduction, the pension schemes have been refined and adjusted in line with changes in economic conditions.

Members of the Board of Managing Directors and senior managers also have individual pension entitlements, which are predominantly based on employer-funded final salary schemes.

There are currently no statutory minimum funding requirements for the existing benefit obligations of Group companies in Germany.

Outside Germany, employees at several companies are also entitled to retirement pensions – some of which are subject to very different rules. The level of these entitlements generally depends on years of service and salary received. The bulk of the benefit obligations outside Germany are financed by investments in external funds.

The Group is exposed to various risks in connection with the defined benefit pension plans. In addition to general actuarial risks such as longevity and interest-rate risk, the Group is exposed to currency risk and – in the case of pension plan assets invested in funds – to capital-market and investment risks.

The calculation of the defined benefit obligations was primarily based on the actuarial assumptions in the table below. The figures stated for the discount rate and income growth outside Germany are averages weighted by the present value of the relevant benefit obligations.

(%)	Dec. 31, 2021 In Germany	Dec. 31, 2021 Outside Germany	Dec. 31, 2020 In Germany	Dec. 31, 2020 Outside Germany
Discount rate	1.30	0.94	1.00	0.61
Income growth (annual)	3.00	1.74	3.00	1.82
Pension adjustment (annual)	1.0 – 1.5	–	1.0 – 1.5	0.0 – 2.8
Future increase in healthcare costs	–	4.0 – 6.0	–	4.0 – 6.3

The defined benefit obligations of the companies in Germany are generally based on the updated biometric factors of the Heubeck 2018 G mortality tables of Professor Dr. Klaus Heubeck. Country-specific biometric factors are used to calculate the obligations of companies outside Germany.

The 'Pensions and similar obligations' line item on the consolidated balance sheet is a net liability that can be broken down as follows:

€ million	Dec. 31, 2021	Dec. 31, 2020
Pensions and similar obligations of companies in Germany	512.4	565.2
Pensions and similar obligations of companies outside Germany	53.6	71.4
Pensions and similar obligations	**566.0**	**636.6**

The table below shows the present value of the defined benefit obligation (broken down by type of cover) and its funded status:

€ million	Dec. 31, 2021 In Germany	Dec. 31, 2021 Outside Germany	Dec. 31, 2021 Total	Dec. 31, 2020 In Germany	Dec. 31, 2020 Outside Germany	Dec. 31, 2020 Total
Present value of funded defined benefit obligation	355.2	148.7	503.9	367.1	152.1	519.2
Present value of unfunded defined benefit obligation	334.0	37.4	371.4	357.2	39.7	396.9
Present value of the defined benefit obligation	**689.2**	**186.1**	**875.3**	**724.3**	**191.8**	**916.1**
Fair value of plan assets	–176.8	–132.5	–309.3	–159.1	–120.4	–279.5
Net liability	**512.4**	**53.6**	**566.0**	**565.2**	**71.4**	**636.6**

The present value of the defined benefit obligation of Group companies changed in 2021 as follows:

€ million	2021 In Germany	2021 Outside Germany	2021 Total	2020 In Germany	2020 Outside Germany	2020 Total
Present value of the defined benefit obligation as of Jan. 1	**724.3**	**191.8**	**916.1**	**667.4**	**181.2**	**848.6**
Currency translation	–	5.6	5.6	–	–2.9	–2.9
Current service cost	11.3	6.9	18.2	10.5	7.4	17.9
Actuarial gains (–)/losses (+)	–41.7	–13.1	–54.8	47.9	8.4	56.3
Interest expense	7.2	1.1	8.3	8.6	1.7	10.3
Employee contributions	6.1	1.7	7.8	6.0	1.8	7.8
Pension payments	–18.0	–7.7	–25.7	–16.1	–5.8	–21.9
Other changes	–	–0.2	–0.2	–	–	–
Present value of the defined benefit obligation as of Dec. 31	**689.2**	**186.1**	**875.3**	**724.3**	**191.8**	**916.1**

A rise or fall of half of one percentage point in the main actuarial assumptions would have the following impact on the present value of the defined benefit obligation in Germany as of the balance sheet date:

Change in present value of defined benefit obligation in Germany (€ million)	Dec. 31, 2021	Dec. 31, 2020
Discount rate		
+ 0.5 percentage points	–65.6	–72.2
– 0.5 percentage points	77.2	84.8
Annual income growth		
+ 0.5 percentage points	2.0	2.5
– 0.5 percentage points	–1.9	–2.5
Annual pension adjustment		
+ 0.5 percentage points	30.3	33.4
– 0.5 percentage points	–27.5	–30.2

Starting with the original actuarial measurements, sensitivity analysis was carried out in isolation on each of the parameters deemed to be material in order to highlight their separate impact on the present value of the defined benefit obligation calculated at each balance sheet date. No potential correlation between the individual assumptions was taken into account. The calculations were repeated with the amended parameters and were not based on estimates so that they reflected the full impact of the changes in isolation.

The actuarial net gains of €41.7 million reported in Germany (2020: net losses of €47.9 million) comprised gains of €44.8 million (2020: losses of €44.7 million) attributable to changes in financial assumptions and losses of €3.1 million (2020: losses of €3.2 million) resulting from experience adjustments.

The present value of the defined benefit obligation was distributed across the following individual groups of pension beneficiaries at companies in Germany:
- active members: €371.8 million (2020: €412.0 million)
- former employees with vested rights: €93.4 million (2020: €88.3 million)
- pensioners and surviving dependants: €224.0 million (2020: €224.0 million)

The benefit obligations of companies outside Germany predominantly consist of obligations to active members of pension schemes. All of the obligations reported on the consolidated balance sheet were vested.

The weighted average duration of obligations in Germany as of December 31, 2021 was 20.4 years (2020: 21.3 years).

The defined benefit obligations in Germany are expected to result in payments as follows at the end of each of the next ten financial years:
- financial year 2022 (year 1): €16.4 million (2020: financial year 2021 – €15.8 million)
- financial years 2023–2026 (years 2 to 5): €73.3 million (2020: financial years 2022–2025 – €70.4 million)
- financial years 2027–2031 (years 6 to 10): €106.0 million (2020: financial years 2026–2030 – €103.1 million)

Outside Germany, pension entitlements are expected to result in pension payments of €9.7 million in 2022 (prior-year expectation for 2021: €9.0 million).

Changes in the fair value of the plan assets during 2021 for companies in and outside Germany are shown below:

€ million	2021			2020		
	In Germany	Outside Germany	Total	In Germany	Outside Germany	Total
Fair value of plan assets as of Jan. 1	**159.1**	**120.4**	**279.5**	**145.1**	**113.9**	**259.0**
Currency translation	–	4.9	4.9	–	–2.1	–2.1
Interest income	1.6	0.8	2.4	1.9	1.1	3.0
Return on (+)/expenses (–) from plan assets excl. interest income	8.6	5.9	14.5	4.1	2.7	6.8
Employer contributions	4.2	6.9	11.1	4.1	6.9	11.0
Employee contributions	6.1	1.7	7.8	6.0	1.7	7.7
Pension payments	–2.8	–8.1	–10.9	–2.1	–3.8	–5.9
Fair value of plan assets as of Dec. 31	**176.8**	**132.5**	**309.3**	**159.1**	**120.4**	**279.5**

Heraeus anticipates that employer contributions to plan assets for companies in Germany will be approximately €5.2 million in 2022 (2021: €4.7 million) and approximately €6.5 million (2021: €6.0 million) for companies outside Germany.

Plan assets relating to companies in and outside Germany comprised the following financial instruments and other assets:

€ million	Dec. 31, 2021			Dec. 31, 2020		
	In Germany	Outside Germany	Total	In Germany	Outside Germany	Total
Debt instruments	120.6	29.3	149.9	108.6	26.4	135.0
Equity instruments	56.1	21.2	77.3	50.4	27.9	78.3
Money-market-linked instruments and credit balances with banks	0.1	5.0	5.1	0.1	5.5	5.6
Real estate	–	11.0	11.0	–	7.9	7.9
Receivables from insurance companies	–	34.6	34.6	–	32.3	32.3
Mixed funds	–	29.8	29.8	–	18.7	18.7
Other assets	–	1.6	1.6	–	1.7	1.7
Fair value of plan assets	**176.8**	**132.5**	**309.3**	**159.1**	**120.4**	**279.5**

Liquid funds intended to meet the defined benefit obligations of companies in Germany are held in several retail funds. These funds are managed by Mercer Treuhand GmbH.

A strategic asset allocation was defined under the asset management strategy. Minimum and maximum quotas were also defined for each asset class, and the allocations should not exceed or fall below these quotas. The prescribed allocation of the assets to different asset classes is based on the term to maturity of the liabilities; the acceptable risk is defined on the basis of stress test scenarios. This strategy should help to generate attractive returns with a virtually constant level of risk. The portfolio is fine-tuned regularly so that the risk can be maintained at a constant level. The costs of managing the retail funds are borne by the funds themselves. The fund's assets do not include financial instruments issued by the company itself, or any real estate or other assets used by the company.

The table below shows a breakdown of the net pension expense reported in the consolidated income statement and the gains and losses recognized in other comprehensive income:

€ million	Note	2021 In Germany	2021 Outside Germany	2021 Total	2020 In Germany	2020 Outside Germany	2020 Total
Current service cost		–11.3	–6.9	–18.2	–10.5	–7.4	–17.9
Interest expense of defined benefit obligation	(32)	–7.2	–1.1	–8.3	–8.6	–1.7	–10.3
Interest income on plan assets	(32)	1.6	0.8	2.4	1.9	1.1	3.0
Net pension expense – reported in the income statement		**–16.9**	**–7.2**	**–24.1**	**–17.2**	**–8.0**	**–25.2**
Actuarial gains/losses in the present value of the defined benefit obligation		41.7	13.1	54.8	–47.9	–8.4	–56.3
Return on/expenses from plan assets excl. interest income		8.6	5.9	14.5	4.1	2.7	6.8
Gains/losses – recognized in other comprehensive income		**50.3**	**19.0**	**69.3**	**–43.8**	**–5.7**	**–49.5**

The current service cost is reported in personnel expenses. The interest expense from unwinding the discount on the defined benefit obligation is offset against the interest income on plan assets and reported in net finance costs.

In addition to the defined benefit pension schemes, there are also defined contribution schemes. Expenses of €6.4 million (2020: €6.9 million) relating to these schemes were recognized in personnel expenses and they mainly concern companies outside Germany. Furthermore, employer contributions of €30.4 million (2020: €30.7 million) were paid into statutory pension insurance in Germany.

22 Provisions

Provisions consist of the following:

€ million	Current provisions Dec. 31, 2021	Current provisions Dec. 31, 2020	Non-current provisions Dec. 31, 2021	Non-current provisions Dec. 31, 2020	Total Dec. 31, 2021	Total Dec. 31, 2020
Provisions						
for personnel expenses	86.1	77.7	22.7	21.6	108.8	99.3
for patent disputes and litigation	19.8	5.5	–	–	19.8	5.5
for restructuring	17.1	30.1	0.8	2.6	17.9	32.7
for outstanding costs for precious metal recycling	9.4	11.5	–	–	9.4	11.5
for warranties	6.8	8.0	0.2	0.6	7.0	8.6
for dismantling and disposal costs	0.2	–	4.5	4.8	4.7	4.8
miscellaneous	16.9	19.3	17.8	25.3	34.7	44.6
Total	**156.3**	**152.1**	**46.0**	**54.9**	**202.3**	**207.0**

The current provisions for personnel expenses of €86.1 million (2020: €77.7 million) include bonus payments, severance payments, performance-related compensation, and other employee benefits. The provisions for restructuring mainly relate to programs that were initiated in 2020 or 2021 and primarily affect locations in Germany.

The non-current provisions for personnel expenses of €22.7 million (2020: €21.6 million) mainly relate to long-service awards.

The following table shows changes in provisions in 2021:

€ million	Jan. 1, 2021	Currency translation	Additions	Unwinding of discount	Utilization	Reversal	Dec. 31, 2021
Provisions							
for personnel expenses	99.3	2.9	80.6	0.2	–69.5	–4.7	108.8
for patent disputes and litigation	5.5	0.2	16.4	–	–1.5	–0.8	19.8
for restructuring	32.7	0.1	6.0	–	–12.8	–8.1	17.9
for outstanding costs for precious metal recycling	11.5	0.4	8.3	–	–10.8	–	9.4
for warranties	8.6	0.2	3.1	–	–4.6	–0.3	7.0
for dismantling and disposal costs	4.8	0.1	0.1	–	–0.3	–	4.7
miscellaneous	44.6	0.4	8.9	–	–17.2	–2.0	34.7
Provisions	**207.0**	**4.3**	**123.4**	**0.2**	**–116.7**	**–15.9**	**202.3**

23 Financial debt

Financial debt is broken down as follows:

	Dec. 31, 2021			Dec. 31, 2020		
€ million	Current	Non-current	Total	Current	Non-current	Total
Registered bonds	–	98.2	98.2	–	98.0	98.0
Lease liabilities	37.3	71.5	108.8	19.8	68.8	88.6
Liabilities to banks	560.2	13.0	573.2	66.7	14.9	81.6
Financial debt	**597.5**	**182.7**	**780.2**	**86.5**	**181.7**	**268.2**

The table below provides a detailed breakdown of the registered bonds:

	Dec. 31, 2021			Dec. 31, 2020		
€ million	Current	Non-current	Total	Current	Non-current	Total
Effective interest rate						
4.01% – fixed rate	–	48.9	48.9	–	48.8	48.8
3.91% – fixed rate	–	49.3	49.3	–	49.2	49.2
Registered bonds	**–**	**98.2**	**98.2**	**–**	**98.0**	**98.0**

Heraeus Finance GmbH issued a registered bond with a nominal amount of €50.0 million and a term of 20 years in October 2012 and a further registered bond with a nominal amount of €50.0 million and a term of 21 years in January 2013. They were recognized at their issue price of 96.452 percent and 97.792 percent respectively; the discount will be amortized over the term of the registered bonds using the effective interest method. Heraeus Holding GmbH became the successor of Heraeus Finance GmbH in relation to these debt instruments and took over all rights and liabilities arising from and in connection with the two registered bonds upon conclusion of a debt assumption agreement on December 13, 2019.

Long-term liabilities to banks predominantly comprise development loans from the KfW banking group that were taken out by Heraeus Holding GmbH. The loans, which must be paid back by December 2022 and March 2026 respectively, have effective interest rates between 0.69 percent and 0.95 percent.

The increase in current liabilities to banks is mainly due to the taking out of a syndicated loan of €500.0 million by Heraeus Holding GmbH in December 2021. The loan has an initial term of twelve months and an effective interest rate of 0.57 percent.

24 Other financial liabilities

Other financial liabilities are broken down as follows:

	Dec. 31, 2021			Dec. 31, 2020		
€ million	Current	Non-current	Total	Current	Non-current	Total
Liabilities from precious metal swaps	521.0	–	521.0	414.7	–	414.7
Derivatives with negative fair value	33.6	1.1	34.7	40.1	0.1	40.2
Miscellaneous financial liabilities	44.2	9.9	54.1	27.1	5.7	32.8
Other financial liabilities	**598.8**	**11.0**	**609.8**	**481.9**	**5.8**	**487.7**

25 Other liabilities

Other liabilities comprise the following items:

	Dec. 31, 2021			Dec. 31, 2020		
€ million	Current	Non-current	Total	Current	Non-current	Total
Liabilities from precious metal trading contracts	205.9	–	205.9	264.7	–	264.7
Other tax liabilities	97.3	–	97.3	30.9	–	30.9
Liabilities for personnel expenses	46.1	2.7	48.8	35.7	3.7	39.4
Contract liabilities	48.0	7.4	55.4	47.7	–	47.7
Miscellaneous non-financial liabilities	88.1	5.1	93.2	90.8	1.2	92.0
Other liabilities	**485.4**	**15.2**	**500.6**	**469.8**	**4.9**	**474.7**

The following table shows changes in contract liabilities in 2021:

€ million	2021	2020
Contract liabilities as of Jan. 1	**47.7**	**21.2**
Currency translation	3.5	-1.3
Additions from business combinations	1.9	0.4
Additions	56.1	45.5
Recognized as revenue	–53.8	–18.1
Contract liabilities as of Dec. 31	**55.4**	**47.7**

26 Trade payables

Trade payables are current liabilities and amounted to €400.5 million as of the end of the financial year (2020: €453.5 million). They also include liabilities in connection with the refining stock owned (see also (6f)).

Notes to the consolidated income statement

27 Revenue

Revenue by field of activity was allocated as follows:

€ million	2021	2020
Health	458.4	350.2
Environmental	531.3	534.7
Electronics	690.2	531.0
Industrials	591.8	635.6
Corporate	0.8	0.5
Revenue excluding precious metals	**2,272.5**	**2,052.0**
Precious metal revenue	**27,233.9**	**29,479.8**
Revenue	**29,506.4**	**31,531.8**

The breakdown of revenue by region was as follows:

€ million	2021	2020
Germany	310.2	223.4
Europe excluding Germany	450.6	429.5
Americas	585.7	496.2
Asia	875.5	857.3
Other	50.5	45.6
Revenue excluding precious metals	**2,272.5**	**2,052.0**
Precious metal revenue	**27,233.9**	**29,479.8**
Revenue	**29,506.4**	**31,531.8**

28 Personnel expenses

Personnel expenses consist of the following:

€ million	2021	2020
Wages and salaries	–759.3	–746.0
Social security contributions and expenses for other benefits	–112.7	–105.7
Pension expenses	–25.5	–26.1
Personnel expenses	**–897.5**	**–877.8**

The breakdown of the average number of employees is as follows:

Field of activity	2021	2020
Health	2,305	2,162
Environmental	2,918	2,963
Electronics	4,203	4,354
Industrials	3,266	3,169
Corporate	1,232	1,475
Total	**13,924**	**14,123**

The remuneration of active members of the Board of Managing Directors for 2021 amounted to €8.6 million (2020: €5.3 million); of which €2.3 million (2020: €2.9 million) was performance related. The remuneration represented short-term employee benefits. In addition, post-employment benefits of the Board of Managing Directors amounted to €1.1 million in 2021 (2020: €0.7 million).

The remuneration of members of the Supervisory Board for 2021 amounted to €0.7 million (2020: €0.7 million). The total remuneration for the Shareholders' Committee was €0.1 million (2020: €0.1 million).

Former members of the Board of Managing Directors or their surviving dependants received remuneration of €1.3 million in 2021 (2020: €1.3 million). Obligations of €22.1 million (2020: €22.1 million) for current pensions and future pension rights existed for these persons as of the balance sheet date.

29 Amortization, depreciation, and impairment

The table below provides a breakdown of depreciation, amortization, and impairment:

€ million	Note	2021	2020
Amortization on intangible assets	(10)	–27.4	–25.6
Depreciation on property, plant, and equipment		–135.6	–129.1
thereof on property, plant, and equipment excluding right-of-use assets	*(11a)*	*–112.6*	*–105.5*
thereof on right-of-use assets	*(11b)*	*–23.0*	*–23.6*
Amortization/depreciation		**–163.0**	**–154.7**
Impairment on intangible assets	(10)	–	–6.1
Impairment on property, plant, and equipment		–27.7	–39.1
thereof on property, plant, and equipment excluding right-of-use assets	*(11a)*	*–27.7*	*–39.1*
thereof on right-of-use assets	*(11b)*	–	–
Impairment		**–27.7**	**–45.2**
Amortization, depreciation, and impairment		**–190.7**	**–199.9**

30 Other operating income

The main individual items in other operating income were income from the reversal of provisions (€3.2 million; 2020: €3.8 million) and from the reversal of impairment on intangible assets and property, plant, and equipment (€1.9 million; 2020: €0.5 million). Other operating income did not include any foreign currency gains (2020: €0.9 million).

31 Other operating expenses

Other operating expenses largely comprised expenses arising from external services (€115.2 million; 2020: €93.7 million), freight out (€60.6 million; 2020: €54.6 million), and maintenance and repairs (€57.9 million; 2020: €61.4 million). Other operating expenses also included foreign currency losses of €4.1 million (2020: €0.0 million).

Expenses for leases where the underlying asset has a low value amounted to €1.9 million (2020: €1.6 million) in the reporting year (see (11b)).

32 Net finance costs

Net finance costs comprise the following income and expenses:

€ million	Note	2021	2020
Interest and similar income		22.9	20.7
Net change in the fair value of financial assets measured at fair value		0.9	0.3
Finance income		**23.8**	**21.0**
Interest expenses and similar charges		–41.9	–48.8
Losses on the measurement of derivatives and loans		–0.9	–1.5
Net interest expense for pensions and similar obligations	(21)	–5.9	–7.3
Interest expenses on lease liabilities	(11b)	–2.7	–2.8
Finance costs		**–51.4**	**–60.4**
Net finance costs		**–27.6**	**–39.4**

33 Income taxes

The breakdown of income taxes is as follows:

€ million	2021	2020
Current taxes in Germany	–21.3	0.5
Current taxes outside Germany	–71.9	–54.8
Current taxes	**–93.2**	**–54.3**
thereof from prior periods	*–5.7*	*4.6*
Deferred taxes	**–33.4**	**–18.0**
Income taxes	**–126.6**	**–72.3**

Deferred taxes are determined on the basis of the local tax rates applicable to each company in or outside Germany in accordance with the current legal situation in the country concerned.

The rates used to calculate deferred and current taxes in Germany were corporate income tax, including the solidarity surcharge, of 15.8 percent (2020: 15.8 percent) and trade tax, which varied from 11.6 percent to 15.8 percent (2020: 10.8 percent to 18.2 percent) depending on the local assessment rate. Consequently, tax rates of 27.5 percent to 31.6 percent (2020: 26.6 percent to 34.0 percent) applied to German Group companies.

Tax rates outside Germany varied between 4.0 percent and 43.0 percent (2020: 4.0 percent and 39.3 percent).

The table below shows the reconciliation of expected income tax expenses to the income tax expenses reported:

€ million	2021	2020
Profit before taxes	**495.9**	**263.0**
Expected income tax expense (tax rate for Hanau site: 30.8 percent; 2020: 30.8 percent)	–152.7	–81.0
Variations:		
Difference between local tax rate and Group tax rate	31.7	22.4
Change in tax rate	–1.6	1.7
Impairment losses/reversals of impairment losses	2.9	–17.8
Tax-exempt income	2.0	0.7
Non-deductible operating expenses for tax purposes	–4.2	–4.5
Income tax for previous years	–5.6	5.0
Other	0.9	1.2
Reported tax expenses	**–126.6**	**–72.3**
Effective tax rate (%)	25.5	27.5

The following deferred tax assets and deferred tax liabilities were attributable to differences in the recognition and measurement of individual line items on the balance sheet and to losses carried forward:

	Deferred tax assets		Deferred tax liabilities		Deferred tax expense (–)/tax income (+) reported in the income statement	
€ million	Dec. 31, 2021	Dec. 31, 2020	Dec. 31, 2021	Dec. 31, 2020	2021	2020
Intangible assets	57.7	50.8	21.6	18.5	–1.4	–17.0
Property, plant, and equipment	6.0	4.4	77.4	71.1	–4.7	–1.3
Inventories	24.8	29.9	74.4	60.3	–19.2	–14.7
Other assets	20.3	10.3	37.0	31.8	2.8	–30.2
Pensions and similar obligations	119.6	114.2	16.6	14.1	–0.9	4.9
Provisions	21.1	22.4	11.3	9.2	–3.4	–3.6
Liabilities	44.9	36.9	5.4	3.6	6.2	16.0
Tax loss carryforwards	20.5	33.3	–	–	–12.8	27.9
Total before offsetting	**314.9**	**302.2**	**243.7**	**208.6**	**–33.4**	**–18.0**
Offsetting	–138.3	–133.0	–138.3	–133.0	–	–
Total	**176.6**	**169.2**	**105.4**	**75.6**	**–33.4**	**–18.0**

Tax loss carryforwards as of December 31, 2021 amounted to €345.3 million (2020: €456.0 million). Deferred tax assets were recognized for €136.5 million of the total tax loss carryforwards (2020: €216.8 million). Loss carryforwards of €57.5 million (2020: €46.8 million) are subject to a time limit, with utilization of €7.9 million restricted to the next three years (2020: €1.0 million). There is no statutory expiration date for loss carryforwards of €287.8 million (2020: €409.2 million). No deferred tax assets were recognized for tax loss carryforwards of €208.8 million (2020: €239.2 million) or for temporary differences arising on measurements for tax purposes in the amount of €159.1 million (2020: €206.1 million).

Based on the earnings forecasts for Group companies that incurred losses in 2021 or preceding years, deferred tax assets of €20.5 million (2020: €33.3 million) were recognized on loss carryforwards, and deferred tax assets of €36.4 million (2020: €40.2 million) were not recognized. Reversals of impairment losses were recognized in the amount of €0.2 million in 2021 (2020: €80.5 million). The utilization of previously unrecognized losses reduced the tax expense by €19.5 million (2020: €1.7 million). After deduction of the deferred tax liabilities, a deferred tax asset of €16.7 million (2020: €42.7 million) was recognized for the consolidated companies with a history of losses. Much of the loss carryforwards for these companies have already been utilized thanks to the strength of business in 2021. Consequently, and on the basis of the budget planning, the remaining loss carryforwards are also expected to be utilized.

Deferred tax liabilities were recognized for temporary differences in investments in subsidiaries when a reversal of these differences was expected.

Notes to the consolidated cash flow statement

Cash flows are reported separately in the consolidated cash flow statement as net cash provided by/net cash used for operating activities, investing activities, or financing activities. Changes in the line items on the balance sheet used to prepare the consolidated cash flow statement are adjusted for the non-cash effects of currency translation and changes in the scope of consolidation. For this reason, the changes in the relevant balance sheet items cannot be directly reconciled with the figures from the consolidated balance sheet.

34 Net cash provided by operating activities

Net cash provided by operating activities is derived indirectly from profit after taxes after adjustment for non-cash income and expenses.

Income tax payments in 2021 amounted to €100.5 million (2020: €87.3 million). The ‘Change in other net assets’ line item contains changes to other financial assets and liabilities and to other assets and liabilities.

Other non-cash transactions and other non-operating expenses essentially comprised deferred taxes, changes in the fair values of derivatives, income from investments accounted for using the equity method, and net pension expenses.

35 Net cash used for investing activities

Outflows of cash and cash equivalents in connection with business combinations amounted to €909.4 million (2020: €76.9 million). This figure includes amounts owed in connection with business combinations in previous years that only caused a cash outflow in the reporting year. In addition, other investments were acquired for an amount of €59.7 million (2020: €14.1 million).

36 Net cash provided by/used for financing activities

In 2021, a dividend of €40.9 million was paid to the shareholders of Heraeus Holding GmbH (2020: €39.9 million); a dividend of 5.2 million (2020: €3.6 million) was paid to the non-controlling interests.

The table below shows the changes in financial liabilities in 2021 for which cash flows have in the past been included or will in the future be included in the consolidated cash flow statement under net cash provided by/used for financing activities:

€ million	Jan. 1, 2021	Cash changes	Non-cash changes			Dec. 31, 2021
			Acquisitions	Currency effects	Other changes	
Non-current financial debt	181.7	–1.9		4.2	–1.3	182.7
Current financial debt	86.5	462.3	20.5	5.6	22.6	597.5
Total	**268.2**	**460.4**	**20.5**	**9.8**	**21.3**	**780.2**

In the reporting year, a total cash outflow of €23.1 million (2020: €27.0 million) was recognized in connection with leases (see (11b)).

The following table shows the corresponding changes in 2020:

€ million	Jan. 1, 2020	Cash changes	Non-cash changes			Dec. 31, 2020
			Acquisitions	Currency effects	Other changes	
Non-current financial debt	178.8	–2.5	5.2	–3.6	3.8	181.7
Current financial debt	61.6	0.4	4.0	–1.5	22.0	86.5
Total	**240.4**	**–2.1**	**9.2**	**–5.1**	**25.8**	**268.2**

The cash changes in liabilities from financing activities can be reconciled to the consolidated cash flow statement as follows:

€ million	Dec. 31, 2021	Dec. 31, 2020
Cash change in liabilities from financing activities	**460.4**	**–2.1**
Distributions, including distributions to non-controlling interests	–46.1	–43.5
Payments for share repurchases	–	–8.2
Interest paid	–42.7	–54.0
Net cash provided by/used for financing activities	**371.6**	**–107.8**

37 Cash and cash equivalents

Cash and cash equivalents at the end of the period consisted exclusively of the cash and cash equivalents reported on the consolidated balance sheet, namely cash on hand, credit balances with banks, short-term money market funds, and other cash amounting to €649.9 million (2020: €853.6 million).

Further disclosures regarding financial instruments

38 Financial risk management

a) General

In its operational and financing activities, the Heraeus Group is primarily exposed to interest-rate risk, currency risk, price risk, credit risk, and liquidity risk. These risks are measured, managed, and monitored by the Group's risk management system and financial management system.

Corporate Treasury and Precious Metal Trading are responsible for mitigating the risks that are described in greater detail below by taking out hedges as and when appropriate. The use of such hedges is governed by clear, standard policies that apply throughout the Group. Compliance is monitored at all times, and policies are amended as required. Heraeus is not exposed to any significant concentrations of risk arising from financial transactions. For further information, please refer to the opportunity and risk report in the group management report.

(b) Interest-rate risk

Interest-rate risk is the risk of changes in interest rates adversely impacting the financial position or financial performance of the Heraeus Group. The avoidance of interest-rate risk always takes priority, but the upside potential of changes in interest rates can also be exploited. The Group's main sources of long-term funding are currently two privately placed registered bonds. Interest-rate derivatives can be used to support interest-rate management. The derivatives that are used can be standard market instruments, such as interest-rate swaps and options for placing upper and lower limits on interest rates (caps, floors, and collars).

As in 2020, Heraeus was not exposed to any material cash-flow interest-rate risk arising from liabilities in 2021, because it had primarily taken out fixed-rate loans.

(c) Currency risk

Because of its international focus, the Heraeus Group is exposed to currency risk, which arises from movements in the exchange rates of various foreign currencies. Again, the avoidance of risk takes precedence over the exploitation of opportunities arising from movements in exchange rates. All hedges relate to underlying transactions that are already in existence or highly probable. As of the balance sheet date, currency risk largely comprised US$ 74.9 million or €66.1 million (2020: US$ 237.3 million or €193.4 million).

To help manage its currency risk, Heraeus uses derivatives based on these underlying transactions. As well as spot transactions, it primarily uses currency forwards and currency swaps.

Currency forwards are used principally to hedge operational cash flows arising from transactions for the supply and purchase of goods and services that are highly probable. Currency swaps are generally entered into in connection with intercompany loans in foreign currency.

(d) Other price risks

Precious metals constitute a key resource in the Heraeus Group. They are subject to market volatility and consequently entail price risk. The Precious Metal Trading unit uses standard market hedging instruments to hedge price risk, mainly precious metal leases, cash-and-carry transactions (precious metal swaps), forwards, and futures. Futures contracts that do not qualify for the own-use exemption and therefore fall within the scope of IFRS 7 do not entail price risk from an economic perspective, because they are taken out to hedge open positions.

(e) Credit risk

Credit risk arising from financial assets consists of the risk that counterparties will default, and hence is limited to a maximum of the carrying amount of the assets transacted with each counterparty. The credit risk relating to derivatives is their replacement cost (market value). The risk of specific counterparties defaulting is constantly monitored using credit spreads and by grouping counterparties into different categories according to their credit quality.

Valuation allowances for expected defaults are recognized to reflect the risk arising from non-derivative financial instruments. Financial transactions are only concluded with top-quality counterparties. Investments in interest-bearing securities, if any, are predominantly limited to investment-grade securities.

(f) Liquidity risk

Liquidity risk describes the risk that a company might be unable to meet its financial obligations in full. Liquidity risk largely results from short-term trade payables, liabilities from derivatives, and other financial liabilities.

As a result of its investment-grade rating, confirmed by two independent rating agencies (see (20)), the Heraeus Group is guaranteed sufficient liquidity. Its rating ensures that it can access both the short-term commercial-paper market and the long-term capital market. It also holds sufficient cash and cash equivalents and has unutilized loan facilities with various banks. Risk concentrations are minimized by limiting the amounts invested at individual, selected investment-grade banks.

The risk of liquidity shortages is monitored by Corporate Treasury. Effective cash management and the ability to access sufficient liquidity even in times of crisis minimize the risk of the Heraeus Group being unable to meet its financial obligations.

(g) Sensitivity analysis

Heraeus uses sensitivity analysis to analyze market risk. The following table shows sensitivity to potential movements in the US dollar exchange rate within reasonable parameters. All other variables remain constant. The impact on profit before taxes of the Heraeus Group is caused by changes in the fair values of financial assets and liabilities. The Group’s risk arising from exchange rate movements in respect of all other currencies is not material.

€ million	Change in USD/EUR exchange rate	Impact on profit before taxes	Impact on shareholders’ equity
2021	+5 %	−3.5	−16.0
	−5 %	3.1	14.5
2020	+5 %	−10.2	−4.1
	−5 %	9.2	3.7

39 Derivative financial instruments

a) Cash flow hedges

In 2021, the rules for hedge accounting were applied for hedging cash flows. The hedges are to protect Heraeus against fluctuations in exchange rates for transactions in 2022 that had already been contractually agreed. As of December 31, 2021, there were currency forwards in the amount of €303.5 million (2020: €77.9 million) that had been entered into in order to hedge cash flows.

The transactions for hedging cash flows arising from anticipated future sales in 2021 have been classified as highly effective. As a result, an unrealized loss before taxes of €7.7 million (2020: unrealized gain before taxes of €2.2 million) was recognized in other comprehensive income in respect of these contracts.

The amounts left in other comprehensive income as of December 31, 2021 are expected to be settled in 2022 and then recognized in profit or loss. Gains before taxes in other comprehensive income in the amount of €2.2 million (2020: €1.2 million) were reclassified to profit or loss during the financial year.

As of the balance sheet date, there were also interest-rate derivatives with a value of €500.0 million that were entered into in order to hedge future interest payments under planned borrowing with a five-year term. The borrowing is considered to be highly probable and is scheduled to take place in 2022. The hedged average basic interest rate is minus 0.0782 percent. Due to the measurement at fair value, an unrealized gain before taxes of €3.6 million was recognized in other comprehensive income.

(b) Economic currency hedges

Currency forwards are generally entered into in connection with intercompany loans in foreign currency and their settlement dates coincide with the maturity dates of the loans. Hedge accounting is not applied to these currency forwards. Consequently, individual currency forward contracts are recognized as assets or liabilities, and changes in their fair value are recognized in profit or loss.

(c) Offsetting of derivatives

The Heraeus Group enters into derivative transactions in accordance with the German Master Agreement for Financial Derivatives Transactions (DRV FT). This agreement does not meet the criteria for offsetting on the consolidated balance sheet, because it only confers the right of offset if future events occur, such as default or insolvency of the Group or of counterparties. The following table shows the potential financial impact of offsetting the arrangements described, regardless of whether they are offset on the consolidated balance sheet pursuant to IAS 32.42.

	Dec. 31, 2021			Dec. 31, 2020		
€ million	Gross amounts of financial instruments on the consolidated balance sheet	Amounts from netting arrangements	Net amounts	Gross amounts of financial instruments on the consolidated balance sheet	Amounts from netting arrangements	Net amounts
Derivative assets	23.8	–1.6	22.2	59.8	–7.9	51.9
Derivative liabilities	34.7	–1.6	33.1	40.2	–7.9	32.3

40 Classification and fair values of financial instruments

a) Categories

The following table shows the carrying amounts of financial instruments by category and the fair values of each class of financial instrument:

€ million	Note	Carrying amount Dec. 31, 2021	Measurement category and carrying amount pursuant to IFRS 9: Fair value hedging instruments	Mandatorily at fair value through profit or loss	Fair value through other comprehensive income	Amortized cost	Fair value Dec. 31, 2021
Financial assets							
Cash and cash equivalents	(17)	649.9	–	–	–	649.9	n/a
Trade receivables	(16)	850.6	–	–	–	850.6	n/a
Other financial assets:							
Derivatives with positive fair value not used as hedges	(13)	20.2	–	20.2	–	–	20.2
Derivatives with positive fair value used as hedges	(13)	3.6	3.6	–	–	–	3.6
Loans	(13)	16.5	–	–	–	16.5	16.5
Other financial assets measured at fair value	(13)	20.4	–	20.0	0.4	–	20.4
Other financial assets	(13)	350.3	–	–	–	350.3	n/a
			3.6	**40.2**	**0.4**	**1,867.3**	
Financial liabilities							
Trade payables	(26)	400.5	–	–	–	400.5	n/a
Financial debt:							
Liabilities to banks	(23)	573.2	–	–	–	573.2	n/a
Registered bonds	(23)	98.2	–	–	–	98.2	126.6
Lease liabilities	(23)	108.8	–	–	–	108.8	n/a
Other financial liabilities:							
Derivatives with negative fair value not used as hedges	(24)	27.0	–	27.0	–	–	27.0
Derivatives with negative fair value used as hedges	(24)	7.7	7.7	–	–	–	7.7
Other financial liabilities measured at fair value	(24)	6.6	–	6.6	–	–	6.6
Other financial liabilities	(24)	568.5	–	–	–	568.5	n/a
			7.7	**33.6**	**–**	**1,749.2**	

€ million	Note	Carrying amount	Measurement category and carrying amount pursuant to IFRS 9: Fair value hedging instruments	Mandatorily at fair value through profit or loss	Fair value through other comprehen-sive income	Amortized cost	Fair value
		Dec. 31, 2020					Dec. 31, 2020
Financial assets							
Cash and cash equivalents	(17)	853.6	–	–	–	853.6	n/a
Trade receivables	(16)	833.5	–	–	–	833.5	n/a
Other financial assets:							
Derivatives with positive fair value not used as hedges	(13)	57.6	–	57.6	–	–	57.6
Derivatives with positive fair value used as hedges	(13)	2.2	2.2	–	–	–	2.2
Loans	(13)	14.4	–	–	–	14.4	14.4
Other financial assets measured at fair value	(13)	10.6	–	10.2	0.4	–	10.6
Other financial assets	(13)	271.7	–	–	–	271.7	n/a
			2.2	**67.8**	**0.4**	**1,973.2**	
Financial liabilities							
Trade payables*	(26)	453.5	–	–	–	453.5	n/a
Financial debt:							
Liabilities to banks	(23)	81.6	–	–	–	81.6	n/a
Registered bonds	(23)	98.0	–	–	–	98.0	134.6
Lease liabilities	(23)	88.6	–	–	–	88.6	n/a
Other financial liabilities:							
Derivatives with negative fair value not used as hedges	(24)	40.2	–	40.2	–	–	40.2
Other financial liabilities measured at fair value	(24)	7.5	–	7.5	–	–	7.5
Other financial liabilities	(24)	440	–	–	–	440.0	n/a
			–	**47.7**	**–**	**1161.7**	

* Prior-year figures restated, see (2)(b)

Cash and cash equivalents, trade receivables, trade payables, liabilities to banks, and other financial assets and liabilities all have predominantly short terms to maturity. No fair values were presented for these financial instruments because they were approximately equal to their carrying amounts.

(b) Fair value measurement

The fair values of derivatives that are traded in an active market are determined based on market prices. Suitable valuation methods taking into account observable market data as of the balance sheet date are used to determine the fair values of derivatives that are not traded in an active market. The fair value of currency forwards is calculated on the basis of the par method based on market data on the balance sheet date. The actual market prices achievable on the balance sheet date may differ from the values calculated in this way. Generally accepted option pricing models (Black-Scholes method) are used to measure the fair value of options. Credit risk is determined using the add-on method and deducted directly from the positive or negative fair value of derivatives.

The discounted cash flow (DCF) method based on inputs observable in the market is used to calculate the fair value of loans and registered bonds.

The fair values recognized for financial instruments were determined as follows:

	Dec. 31, 2021		Dec. 31, 2020	
€ million	Assets	Liabilities	Assets	Liabilities
Mark-to-model values determined using parameters observed in the market (Level 2)	**23.8**	**–34.7**	**59.8**	**–40.2**
Other financial assets:	23.8	–	59.8	–
Derivatives with positive fair value not used as hedges	20.2	–	57.6	–
Derivatives with positive fair value used as hedges	3.6	–	2.2	–
Other financial liabilities:	–	–34.7	–	–40.2
Derivatives with negative fair value not used as hedges	–	–27.0	–	–40.2
Derivatives with negative fair value used as hedges	–	–7.7	–	–
Theoretical mark-to-model values (Level 3)	**20.4**	**–6.6**	**10.6**	**–7.5**
Other financial assets	20.4	–	10.6	–
Other financial liabilities	–	–6.6	–	–7.5

The DCF method based on unobservable inputs, such as economic growth and the discount rate, is used to determine the fair values recognized at Level 3. A change in the input factors as part of a sensitivity analysis does not have any material effect on measurement. The following table shows the change in the fair values of other financial assets and other financial liabilities at Level 3 in 2021:

	2021		2020	
€ million	Assets	Liabilities	Assets	Liabilities
Balance as of Jan. 1	**10.6**	**–7.5**	**8.5**	**–9.8**
Gains/losses recognized in profit or loss	0.7	–0.7	0.1	0.4
Additions	8.9	–3.1	2.0	–3.1
Disposals/settlements	–	5.0	–	4.6
Exchange differences recognized in other comprehensive income	0.2	–0.3	–	0.4
Balance as of Dec. 31	**20.4**	**–6.6**	**10.6**	**–7.5**

At the end of each reporting period, the financial assets and liabilities measured at fair value are assessed to ascertain whether they need to be transferred between levels of the fair value hierarchy. As in 2020, there were no transfers during the reporting year.

The fair values disclosed for financial instruments measured at amortized cost were determined as follows:

	Dec. 31, 2021		Dec. 31, 2020	
€ million	Assets	Liabilities	Assets	Liabilities
Mark-to-model values determined using parameters observed in the market (Level 2)	**16.5**	**–132.5**	**14.4**	**–134.6**
Loans	16.5	–	14.4	–
Registered bonds	–	–132.5	–	–134.6

41 Net gains and losses on financial instruments

The following table shows net gains/losses by measurement category:

€ million	2021	2020
Financial assets and financial liabilities mandatorily measured at fair value through profit and loss	–1.1	14.7
Financial assets measured at amortized cost	10.6	–20.7
Financial liabilities measured at amortized cost	–12.4	–11.9
Net gain/loss	**–2.9**	**–17.9**

The net gain/loss on financial assets and liabilities measured at fair value through profit or loss is the result of measurement subsequent to initial recognition and includes net interest income/expense. In all other categories, net interest income/expense and net gains/losses on currency translation, impairment, and disposal were taken into account.

In 2021, interest income of €2.6 million (2020: €2.3 million) was generated and interest expenses of €12.4 million (2020: €11.9 million) were incurred in connection with financial assets and liabilities that are not measured at fair value through profit or loss.

42 Maturity analysis

The following table shows the contractually agreed (undiscounted) principal payments, including estimated interest payments, of the non-derivative financial liabilities and derivative financial liabilities held on the Heraeus Group's books as of December 31, 2021:

	Cash flows			
€ million	2022	2023	2024 – 2026	from 2027
Non-derivative financial liabilities:				
Registered bonds	1.4	3.8	11.3	126.3
Liabilities to banks	560.2	6.7	6.3	–
Trade payables	400.5	–	–	–
Lease liabilities	40.4	17.6	33.0	33.5
Other financial liabilities	565.2	5.8	1.0	3.3
Derivative financial liabilities:				
Derivatives with negative fair value not used as hedges	25.9	–	0.8	0.2
Derivatives with negative fair value used as hedges	7.7	–	–	–

The contractually agreed (undiscounted) interest and principal payments for the non-derivative financial liabilities and the derivative financial liabilities as of December 31, 2020 were as follows:

	Cash flows			
€ million	2021	2022	2023 – 2025	from 2026
Non-derivative financial liabilities:				
Registered bonds	1.4	3.8	11.3	130.0
Liabilities to banks	69.7	3.0	8.6	0.7
Trade payables*	453.5	–	–	–
Lease liabilities	22.5	17.3	31.9	31.3
Other financial liabilities	441.8	4.9	1.0	0.1
Derivative financial liabilities:				
Derivatives with negative fair value not used as hedges	40.1	0.1	–	–

* Prior-year figures restated, see (2)(b)

Variable cash flows were recognized at the reference interest rate applicable as of each balance sheet date. Foreign currency amounts were translated at the spot rate applicable as of each balance sheet date.

Other disclosures

43 Contingent liabilities

There were no material contingent liabilities as of the balance sheet date.

44 Other financial commitments

As of the balance sheet date, purchase commitments for capital expenditure on property, plant, and equipment payable in 2022 amounted to €83.2 million (2020: €115.0 million payable in 2021).

For the purpose of sourcing precious metals, Heraeus enters into transactions such as precious metal leases as lessee and sometimes as lessor. In a leasing transaction, the lessor transfers to the lessee a contractually determined quantity of a precious metal for a fixed period of time and receives interest in return for transferring the precious metal. The Heraeus Group generally enters into precious metal leases with a maximum term of twelve months. As lessee, Heraeus is not required to recognize the precious metals it has leased or its corresponding obligations to return them in its consolidated balance sheet.

As of the balance sheet date, the total market value of the precious metals on loan from third parties amounted to €1,902.0 million (2020: €1,628.0 million).

The Group's supply of precious metals is partly secured by medium- to long-term framework agreements. The quantity to be purchased can be onsold at any time with no price risk.

45 Related party disclosures

Disclosures regarding remuneration for the Board of Managing Directors, Supervisory Board, and Shareholders' Committee can be found in note (28).

From a capital perspective, the shares in Heraeus Holding GmbH are predominantly held by EVG Tertio GmbH & Co. KG. However, no significant voting rights are attached to these shares. Consequently, no consolidated financial statements are prepared at this level. The voting shares in Heraeus Holding GmbH and the shares in Einhorn Verwaltungsgesellschaft mbH (parent company of EVG Tertio GmbH & Co. KG) are in free float and are held by a number of shareholders.

The following table shows material trading relationships between Group entities and related parties:

	Receivables		Liabilities		Revenue		Goods and services received	
€ million	Dec. 31, 2021	Dec. 31, 2020	Dec. 31, 2021	Dec. 31, 2020	2021	2020	2021	2020
Associates	10.1	10.1	–	–	57.7	13.9	–	–
Joint ventures	9.6	5.2	1.2	0.7	32.8	30.9	8.3	12.5
Total	**19.7**	**15.3**	**1.2**	**0.7**	**90.5**	**44.8**	**8.3**	**12.5**

These trading relationships mainly relate to the field of activity Electronics.

Receivables include loans to associates in an amount of €10.0 million (2020: €10.0 million) and loans to joint ventures in an amount of €4.4 million (2020: €2.4 million). These loans have a long term to maturity and are not collateralized.

46 Events after the reporting period

At the end of January 2022, Heraeus Medical GmbH and Zimmer Biomet Holdings Inc. achieved a first breakthrough in reaching a mutually acceptable solution in respect of the long-standing legal disputes between the two companies. Heraeus Medical had accused Zimmer Biomet of illegally exploiting its trade secrets. The agreement between the parties includes a payment in the low-triple-digit millions to be made by Zimmer Biomet to Heraeus Medical. In return, all currently pending lawsuits will be ended. On March 3, 2022, the parties signed the final settlement agreement that, among other things, sets out the details of the solution reached, such as payment terms for the settlement amount, the scope of the settled claims, the winding up of the pending legal proceedings, and the future handling of confidential information.

Additional disclosures pursuant to the German Commercial Code (HGB)

47 Auditors' fees

The total fees invoiced by Ernst & Young GmbH Wirtschaftsprüfungsgesellschaft for auditing services in 2021 amounted to €1.9 million (2020: €1.6 million). The fee for other services was €0.2 million (2020: €0.4 million).

48 Exemption pursuant to section 264 (3) HGB and section 264b HGB

The following German subsidiaries will make use of the exemption provisions of section 264 (3) HGB and section 264b HGB for 2021:

Heraeus Amloy Technologies GmbH, Hanau
Heraeus Battery Technology GmbH, Hanau
Heraeus Beteiligungsverwaltungsgesellschaft mbH, Hanau
Heraeus Consulting & IT Solutions GmbH, Hanau
Heraeus Deutschland GmbH & Co. KG, Hanau
Heraeus Electro-Nite GmbH & Co. KG, Hanau
Heraeus Finance GmbH, Hanau
Heraeus Medical GmbH, Wehrheim
Heraeus Metals Germany GmbH & Co. KG, Hanau
Heraeus Nexensos GmbH, Hanau
Heraeus Noblelight GmbH, Hanau
Heraeus Quarzglas Bitterfeld GmbH & Co. KG, Hanau
Heraeus Quarzglas GmbH & Co. KG, Hanau
Heraeus Quarzglas International GmbH, Hanau
Heraeus Quarzglas Verwaltungsgesellschaft mbH, Hanau
Heraeus Site Operations GmbH & Co. KG, Hanau
Heraeus Site Operations III GmbH & Co. KG, Hanau
Heraeus UV Solutions GmbH, Hanau
Huvenca 1 GmbH, Hanau

49 List of shareholdings

The shareholdings of Heraeus Holding GmbH as of December 31, 2021 are listed below:

Name of company	Registered office	Country	Percentage of equity
1. Subsidiaries included in the consolidated financial statements			
In Germany			
Amorphous Metal Solutions GmbH	Homburg	Germany	100.00
Argor-Heraeus Deutschland GmbH	Pforzheim	Germany	100.00
Contract Medical International GmbH	Dresden	Germany	100.00
Heraeus Amloy Technologies GmbH	Hanau	Germany	100.00
Heraeus Battery Technology GmbH	Hanau	Germany	100.00
Heraeus Beteiligungsverwaltungsgesellschaft mbH	Hanau	Germany	100.00
Heraeus Consulting & IT Solutions GmbH	Hanau	Germany	100.00
Heraeus Deutschland GmbH & Co. KG	Hanau	Germany	100.00
Heraeus Deutschland Verwaltungs GmbH	Hanau	Germany	100.00
Heraeus Electro-Nite GmbH & Co. KG	Hanau	Germany	100.00
Heraeus Electro-Nite Verwaltungsgesellschaft mbH	Hanau	Germany	100.00
Heraeus Finance GmbH	Hanau	Germany	100.00
Heraeus Medical GmbH	Wehrheim	Germany	100.00
Heraeus Metals Germany GmbH & Co. KG	Hanau	Germany	100.00
Heraeus Metals Germany Treuhand GmbH	Hanau	Germany	100.00
Heraeus Nexensos GmbH	Hanau	Germany	100.00
Heraeus Noblelight GmbH	Hanau	Germany	100.00
Heraeus Quarzglas Bitterfeld GmbH & Co. KG	Hanau	Germany	100.00
Heraeus Quarzglas GmbH & Co. KG	Hanau	Germany	100.00
Heraeus Quarzglas International GmbH	Hanau	Germany	100.00
Heraeus Quarzglas Treuhand GmbH	Hanau	Germany	100.00
Heraeus Quarzglas Verwaltungsgesellschaft mbH	Hanau	Germany	100.00
Heraeus Site Operations Energy GmbH	Hanau	Germany	100.00
Heraeus Site Operations GmbH & Co. KG	Hanau	Germany	100.00
Heraeus Site Operations III GmbH & Co. KG	Hanau	Germany	100.00
Heraeus Site Operations Verwaltungs GmbH	Hanau	Germany	100.00
Heraeus UV Solutions GmbH	Hanau	Germany	100.00
HUVENCA 1 GmbH	Hanau	Germany	100.00
W.C. Heraeus International GmbH	Hanau	Germany	100.00

Name of company	Registered office	Country	Percentage of equity
Outside Germany			
Argor-Heraeus Italia S.p.A.	Cavenago Brianza	Italy	100.00
Argor-Heraeus SA	Mendrisio	Switzerland	100.00
Contract Medical International, spol. s.r.o.	Hradec Králové	Czech Republic	100.00
Dong Yang Ceramic Inc.	Pyeongtaek-si	South Korea	100.00
ETS Wound Care LLC	Rolla, MO	USA	100.00
Heraeus (China) Investment Co., Ltd.	Shanghai	China	100.00
Heraeus (Thailand) Ltd.	Bangkok	Thailand	100.00
Heraeus Asia Pacific Holding Pte. Ltd.	Singapore	Singapore	100.00
Heraeus Conamic North America LLC	Milford, DE	USA	100.00
Heraeus Conamic UK Ltd.	Wallsend	UK	100.00
Heraeus CZ s.r.o.	Prague	Czech Republic	100.00
Heraeus Electro-Nite (Aust.) Pty. Ltd.	Unanderra	Australia	100.00
Heraeus Electro-Nite (Pty.) Ltd.	Boksburg	South Africa	100.00
Heraeus Electro-Nite (UK) Ltd.	Chesterfield	UK	100.00
Heraeus Electro-Nite AB	Lidingö	Sweden	100.00
Heraeus Electro-Nite Canada Ltd.	Toronto, ON	Canada	100.00
Heraeus Electro-Nite Chelyabinsk LLC	Chelyabinsk	Russia	100.00
Heraeus Electro-Nite Co., LLC	Dover, DE	USA	100.00
Heraeus Electro-Nite Espana S.L.	Cayés, Llanera	Spain	100.00
Heraeus Electro-Nite France S.A.R.L.	Illange	France	100.00
Heraeus Electro-Nite Instrumentos Ltda.	Diadema, SP	Brazil	100.00
Heraeus Electro-Nite International N.V.	Houthalen	Belgium	100.00
Heraeus Electro-Nite Italy S.r.L.	Ornago, Milan	Italy	100.00
Heraeus Electro-Nite Japan, Ltd.	Ichikawa-shi	Japan	100.00
Heraeus Electro-Nite L.L.C.	Moscow	Russia	100.00
Heraeus Electro-Nite Mexicana S.A. de C.V.	Ramos Arizpe, COA	Mexico	100.00
Heraeus Electro-Nite Polska Sp. z o.o.	Sosnowiec	Poland	100.00
Heraeus Electro-Nite Shanghai Co. Ltd.	Shanghai	China	100.00
Heraeus Electro-Nite Shenyang Co. Ltd.	Shenyang	China	100.00
Heraeus Electro-Nite Taicang Co. Ltd.	Taicang	China	100.00
Heraeus Electro-Nite Taiwan Ltd.	Kaohsiung City	Taiwan	100.00
Heraeus Electro-Nite Termoteknik Sanayi ve Ticaret A.S.	Sincan, Ankara	Turkey	100.00
Heraeus Electro-Nite Ukraina LLC	Zaporozhye	Ukraine	100.00
Heraeus Epurio LLC	Dover, DE	USA	100.00
Heraeus Hellas Monoprosopi EPE	Athens	Greece	100.00
Heraeus Inc.	Dover, DE	USA	100.00
Heraeus K.K.	Tokyo	Japan	100.00
Heraeus Korea Corporation	Suwon-si	South Korea	100.00
Heraeus Ltd.	Hong Kong	China	100.00
Heraeus Materials Malaysia Sdn. Bhd.	Kuala Lumpur	Malaysia	100.00
Heraeus Materials S.A.	Yverdon-les-Bains	Switzerland	100.00
Heraeus Materials Singapore Pte. Ltd.	Singapore	Singapore	100.00
Heraeus Materials Technology Shanghai Ltd.	Shanghai	China	100.00
Heraeus Materials Technology Taiwan Ltd.	Taipei City	Taiwan	100.00

Name of company	Registered office	Country	Percentage of equity
Heraeus Medical AB	Stockholm	Sweden	100.00
Heraeus Medical Australia Pty. Ltd.	Macquarie Park, NSW	Australia	100.00
Heraeus Medical Components Caribe, Inc.	San Juan	Puerto Rico	100.00
Heraeus Medical Components LLC	Dover, DE	USA	100.00
Heraeus Medical Components S.R.L.	San Antonio de Belén	Costa Rica	100.00
Heraeus Medical Components Singapore Pte. Ltd.	Singapore	Singapore	100.00
Heraeus Medical LLC	Dover, DE	USA	100.00
Heraeus Medical Poland Sp. z o.o.	Warsaw	Poland	100.00
Heraeus Medical Schweiz AG	Zurich	Switzerland	100.00
Heraeus Metal Processing Ltd.	Shannon	Ireland	100.00
Heraeus Metals (Shanghai) Co., Ltd.	Shanghai	China	100.00
Heraeus Metals Hong Kong Ltd.	Hong Kong	China	100.00
Heraeus Metals New York LLC	Dover, DE	USA	100.00
Heraeus Nederland B.V.	Amsterdam	Netherlands	100.00
Heraeus Noblelight (Shenyang) Ltd.	Shenyang	China	100.00
Heraeus Noblelight America LLC	Dover, DE	USA	100.00
Heraeus Noblelight Ltd.	Cambridge	UK	100.00
Heraeus PGM SA (Pty.) Ltd.	Port Elizabeth	South Africa	100.00
Heraeus Photovoltaics (Shanghai) Co., Ltd.	Shanghai	China	100.00
Heraeus Photovoltaics Singapore Pte. Ltd.	Singapore	Singapore	100.00
Heraeus Photovoltaics Technology (Shanghai) Co., Ltd.	Shanghai	China	100.00
Heraeus Precious Metal Technology (China) Co., Ltd.	Nanjing	China	100.00
Heraeus Precious Metals North America Conshohocken LLC	Dover, DE	USA	100.00
Heraeus Precious Metals North America LLC	Dover, DE	USA	100.00
Heraeus Quartz North America LLC	Dover, DE	USA	100.00
Heraeus Romania S.R.L.	Chișoda	Romania	100.00
Heraeus SAH (Pty.) Ltd.	Port Elizabeth	South Africa	100.00
Heraeus S.A.	Madrid	Spain	100.00
Heraeus S.A.S.	Villebon-sur-Yvette	France	100.00
Heraeus S.p.A.	Milan	Italy	100.00
Heraeus ShinEtsu Quartz (China) Inc.	Shenyang	China	66.67
Heraeus South Africa (Pty.) Ltd.	Port Elizabeth	South Africa	100.00
Heraeus Technologies India Private Ltd.	New Delhi	India	100.00
Heraeus Tokmak Kiymetli Madenler Sanayi A.S.	Kemalpasa, Izmir	Turkey	95.00
Heraeus TROT (Wuhan) Engineering and Technology Co., Ltd.	Wuhan	China	100.00
Heraeus Zhaoyuan Changshu Electronic Materials Co. Ltd.	Changshu	China	80.00
Heraeus Zhaoyuan Precious Metal Materials Co. Ltd.	Zhaoyuan	China	60.00
HS Advanced Materials Co., Ltd.	Gwanghyewon-myun	South Korea	100.00
MC Sublance Probe Technology Shanghai Co., Ltd.	Shanghai	China	100.00
Minco (Shanghai) Metallurgical Co., Ltd.	Shanghai	China	100.00
Mo Sci LLC	Rolla, MO	USA	100.00
Norwood Medical LLC	Wilmington, DE	USA	100.00
PT. Woojin Electro Nite Indonesia	Cilegon	Indonesia	100.00
Pulse Systems, LLC	Wilmington, DE	USA	100.00
Shree Ram Measurement Technologies Pvt. Ltd.	New Delhi	India	100.00
Woojin Electro-Nite Inc.	Pyeongtaek-si	South Korea	100.00

Name of company	Registered office	Country	Percentage of equity
2. Subsidiaries not included in the consolidated financial statements			
In Germany			
Heraeus Business Solutions GmbH	Hanau	Germany	100.00
Outside Germany			
ETS Technology Holdings LLC	Rolla, MO	USA	100.00
HEN RBS Trustees Ltd.	Chesterfield	UK	100.00
Heraeus Nexensos Malaysia Sdn. Bhd.	Kuala Lumpur	Malaysia	100.00
Mo Sci Health Care LLC	Rolla, MO	USA	100.00
PT Heraeus Materials Indonesia	Tangerang City	Indonesia	99.59
3. Associates accounted for under the equity method included in the consolidated financial statements			
Outside Germany			
Ankasa Regenerative Therapeutics, Inc.	Wilmington, DE	USA	27.94
Choksi Heraeus Private Ltd.	Udaipur, Rajasthan	India	50.00
Ravindra Heraeus Private Ltd.	Udaipur, Rajasthan	India	50.00
4. Joint ventures accounted for under the equity method included in the consolidated financial statements			
In Germany			
perPETual Technologies GmbH	Hanau	Germany	53.38
Outside Germany			
Argor-Aljba SA	Mendrisio	Switzerland	50.00
Heraeus Shin-Etsu Quartz Singapore Pte. Ltd.	Singapore	Singapore	50.00
Shin-Etsu Quartz Products Co., Ltd.	Tokyo	Japan	50.00
Young Shin Quartz Co., Ltd.	Gwanghyewon-myun	South Korea	50.00

Hanau, March 10, 2022
The Board of Managing Directors of Heraeus Holding GmbH

Jan Rinnert
Chairman

Dr. André Kobelt

Dr. Frank Stietz

Rolf Wetzel

Independent auditor's report

To Heraeus Holding GmbH

Opinions

We have audited the consolidated financial statements of Heraeus Holding GmbH, Hanau, and its subsidiaries (the Group), which comprise the consolidated statement of financial position as at 31 December 2021, and the consolidated income statement, consolidated statement of comprehensive income, consolidated statement of changes in equity and consolidated statement of cash flows for the fiscal year from 1 January to 31 December 2021, and notes to the consolidated financial statements, including a summary of significant accounting policies. In addition, we have audited the group management report of Heraeus Holding GmbH, Hanau, for the fiscal year from 1 January to 31 December 2021. We have not audited the content of the section "Compliance report" of the group management report.

In our opinion, on the basis of the knowledge obtained in the audit,

- the accompanying consolidated financial statements comply, in all material respects, with the IFRSs as adopted by the EU, and the additional requirements of German commercial law pursuant to Sec. 315e (1) HGB ["Handelsgesetzbuch": German Commercial Code] and, in compliance with these requirements, give a true and fair view of the assets, liabilities and financial position of the Group as at 31 December 2021 and of its financial performance for the fiscal year from 1 January to 31 December 2021, and
- the accompanying group management report as a whole provides an appropriate view of the Group's position. In all material respects, this group management report is consistent with the consolidated financial statements, complies with German legal requirements and appropriately presents the opportunities and risks of future development. Our opinion on the group management report does not cover the content of the abovementioned section "Compliance report" in the group management report.

Pursuant to Sec. 322 (3) Sentence 1 HGB, we declare that our audit has not led to any reservations relating to the legal compliance of the consolidated financial statements and of the group management report.

Basis for the opinions

We conducted our audit of the consolidated financial statements and of the group management report in accordance with Sec. 317 HGB and in compliance with German Generally Accepted Standards for Financial Statement Audits promulgated by the Institut der Wirtschaftsprüfer [Institute of Public Auditors in Germany] (IDW). Our responsibilities under those requirements and principles are further described in the "Auditor's responsibilities for the audit of the consolidated financial statements and of the group management report" section of our auditor's report. We are independent of the group entities in accordance with the requirements of German commercial and professional law, and we have fulfilled our other German professional responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinions on the consolidated financial statements and on the group management report.

Other information

The supervisory board is responsible for the supervisory board report. In all other respects, the executive directors are responsible for the other information. The other information comprises parts to be included in the annual report, of which we received a version prior to issuing this auditor's report, in particular:

- Report of the supervisory board
- Foreword by the management board
- Multiple-year overview

In addition, the section "Compliance report" in the group management report is part of "Other information".

Our opinions on the consolidated financial statements and on the group management report do not cover the other information, and consequently we do not express an opinion or any other form of assurance conclusion thereon.

In connection with our audit, our responsibility is to read the other information and, in so doing, to consider whether the other information

- is materially inconsistent with the consolidated financial statements, with the group management report or our knowledge obtained in the audit, or
- otherwise appears to be materially misstated.

Responsibilities of the executive directors and the supervisory board for the consolidated financial statements and the group management report

The executive directors are responsible for the preparation of the consolidated financial statements that comply, in all material respects, with IFRSs as adopted by the EU and the additional requirements of German commercial law pursuant to Sec. 315e (1) HGB, and that the consolidated financial statements, in compliance with these requirements, give a true and fair view of the assets, liabilities, financial position and financial performance of the Group. In addition, the executive directors are responsible for such internal control as they have determined necessary to enable the preparation of consolidated financial statements that are free from material misstatement, whether due to fraud or error.

In preparing the consolidated financial statements, the executive directors are responsible for assessing the Group's ability to continue as a going concern. They also have the responsibility for disclosing, as applicable, matters related to going concern. In addition, they are responsible for financial reporting based on the going concern basis of accounting unless there is an intention to liquidate the Group or to cease operations, or there is no realistic alternative but to do so.

Furthermore, the executive directors are responsible for the preparation of the group management report that, as a whole, provides an appropriate view of the Group's position and is, in all material respects, consistent with the consolidated financial statements, complies with German legal requirements, and appropriately presents the opportunities and risks of future development. In addition, the executive directors are responsible for such arrangements and measures (systems) as they have considered necessary to enable the preparation of a group management report that is in accordance with the applicable German legal requirements, and to be able to provide sufficient appropriate evidence for the assertions in the group management report.

The supervisory board is responsible for overseeing the Group's financial reporting process for the preparation of the consolidated financial statements and of the group management report.

Auditor's responsibilities for the audit of the consolidated financial statements and of the group management report

Our objectives are to obtain reasonable assurance about whether the consolidated financial statements as a whole are free from material misstatement, whether due to fraud or error, and whether the group management report as a whole provides an appropriate view of the Group's position and, in all material respects, is consistent with the consolidated financial statements and the knowledge obtained in the audit, complies with the German legal requirements and appropriately presents the opportunities and risks of future development, as well as to issue an auditor's report that includes our opinions on the consolidated financial statements and on the group management report.

Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with Sec. 317 HGB and in compliance with German Generally Accepted Standards for Financial Statement Audits promulgated by the Institut der Wirtschaftsprüfer (IDW) will always detect a material misstatement. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these consolidated financial statements and this group management report.

We exercise professional judgment and maintain professional skepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the consolidated financial statements and of the group management report, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinions. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.
- Obtain an understanding of internal control relevant to the audit of the consolidated financial statements and of arrangements and measures (systems) relevant to the audit of the group management report in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of these systems.
- Evaluate the appropriateness of accounting policies used by the executive directors and the reasonableness of estimates made by the executive directors and related disclosures.
- Conclude on the appropriateness of the executive directors' use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Group's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in the auditor's report to the related disclosures in the consolidated financial statements and in the group management report or, if such disclosures are inadequate, to modify our respective opinions. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Group to cease to be able to continue as a going concern.

- Evaluate the overall presentation, structure and content of the consolidated financial statements, including the disclosures, and whether the consolidated financial statements present the underlying transactions and events in a manner that the consolidated financial statements give a true and fair view of the assets, liabilities, financial position and financial performance of the Group in compliance with IFRSs as adopted by the EU and the additional requirements of German commercial law pursuant to Sec. 315e (1) HGB.
- Obtain sufficient appropriate audit evidence regarding the financial information of the entities or business activities within the Group to express opinions on the consolidated financial statements and on the group management report. We are responsible for the direction, supervision and performance of the group audit. We remain solely responsible for our audit opinions.
- Evaluate the consistency of the group management report with the consolidated financial statements, its conformity with [German] law, and the view of the Group's position it provides.
- Perform audit procedures on the prospective information presented by the executive directors in the group management report. On the basis of sufficient appropriate audit evidence we evaluate, in particular, the significant assumptions used by the executive directors as a basis for the prospective information, and evaluate the proper derivation of the prospective information from these assumptions. We do not express a separate opinion on the prospective information and on the assumptions used as a basis. There is a substantial unavoidable risk that future events will differ materially from the prospective information.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

Eschborn/Frankfurt am Main, 10 March 2022

Ernst & Young GmbH

Wirtschaftsprüfungsgesellschaft

Bösser
Wirtschaftsprüfer
[German Public Auditor]

But
Wirtschaftsprüfer
[German Public Auditor]

Multi-year overview

€ million	2021	2020	2019	2018	2017
Financial performance (€ million)					
Revenue excluding precious metals	2,272	2,052	2,200	2,259	2,185
Total revenue	29,506	31,532	21,570	20,295	21,844
Earnings before interest and tax (EBIT)	524	302	222	341	299
Profit after taxes	369	191	115	197	210
Financial position (€ million)					
Total assets*	6,994	5,915	5,497	5,068	4,829
Shareholders' equity	3,801	3,280	3,293	3,223	3,010
Equity-to-assets ratio (%)*	54	56	60	64	62
Cash flow (€ million)					
Net cash provided by operating activities	608	345	378	449	244
Cash payments for investments in non-current assets	248	197	233	257	196
Depreciation, amortization, and impairment of non-current assets	168	176	158	143	192
Employees					
Employees at year-end	15,114	13,911	14,190	13,858	13,073
In Germany	5,149	5,290	5,464	5,418	4,864
Outside Germany	9,965	8,621	8,726	8,440	8,209

* The comparative information for 2020 has been restated; see note (2)(b) of the notes to the consolidated financial statements.

Legal notice

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This financial report contains the full consolidated financial statements and group management report of Heraeus Holding GmbH, Hanau, for 2021 as well as additional voluntary disclosures.

This financial report is also available in German.

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