

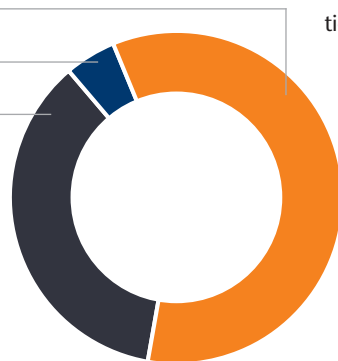
## 2.3 Research and Development

“Creating competitive advantages for our customers” is the aim of research and development (R&D) in the Salzgitter Group. This means that research and development is practiced as a close cooperation between the central research function, Group companies concerned with either manufacturing or sales and, last, but not least, our customers. The main focus is on new products as well as processes and techniques, including the contribution of research and development to aspects of energy efficiency and ecological compatibility.

Salzgitter Mannesmann Forschung GmbH (SZMF) is the central coordinating unit for research and development activities concerned with innovative processes, and structures the key contents and project areas. On the one hand, it is possible for SZMF to map and reproduce the entire process chain, from the production of liquid metal to the finished product, both in theory and on laboratory scale. On the other

Research and Development Expenses by Divisions

Steel 59%  
Services 5%  
Tubes 36%



hand, SZMF performs an intermediary function between both application-oriented research conducted in-house, as well as basic research carried out at centers of expertise such as public research institutions, universities and colleges. A total of 53 active multilateral projects involving international participation bear impressive witness to this position within an extensive research network.

Cooperation within the field of research is given clear preference over the buying-in of know-how. As a result, there was no expenditure for the latter in 2005.

In 2005, the Salzgitter Group spent € 58 million on R&D activities and on R&D-relevant and -related quality management projects. Of these, 59% were attributable to the Steel Division, 36% to Tubes Division and 5% to the Services Division. R&D expenses amounted to 2.9% of Group value-added. Some 706 employees were engaged in R&D activities.

In order to be able to map and reproduce the process chain to the leading edge of science and technology, in 2005 we invested in, among other things, a surface technology laboratory as well as devices and equipment that characterize the properties of materials. The newly installed surface technology laboratory is able to carry out both existing and future processes, ranging from hot-dip galvanizing to painting, on a laboratory scale and under production conditions, and then analyze the results. Among the devices designed to characterize the properties of materials, a scanning electron microscope with a field emission gun and a microprobe deserve particular mention. Both devices are equipped with extensive analysis tools and also facilitate, by way of example, the investigation of the finest nanoscale and micro-scale coatings that are increasingly used in the latest products.

Besides establishing the qualities of materials, the monitoring of processes is indispensable, not only for steel plate production but also for the production of tubes. Appropriate testing facilities that deliver a process-like simulation of forming conditions help to optimize production parameters for different

utilized materials. With the “Gleeble 3500”, SZMF is replacing an existing system that simulates the workability of steels in the manufacturing of seamless tube grades. This significantly expands this testing unit’s utilization range.

R&D-relevant investments amounted to a total of approximately € 7.5 million.

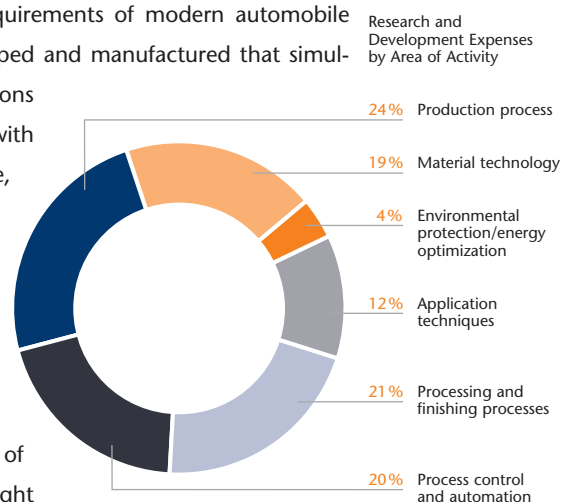
Air-hardening steels offer greater efficiency and benefits in replacing QT-steels and case-hardened steels. The production of air-hardening steels dispenses with the quenchants otherwise required in hardening such steels. The technological advantages of these steels that have been developed with a strong participation of automotive manufacturers are also reflected in cost advantages compared with the use of aluminum, for example. We have been able to realize significant synergy effects from the shared development of grades and qualities for plates and tubes.

Since 2005 we have been able to offer newly developed, chromate-free surface treatments for strip-coated, hot-galvanized and electrogalvanized products. This allows us to provide our customers with the opportunity of adapting to future EU guidelines at an early stage.

Hydro-formed exhaust systems are suited to the demanding requirements of modern automobile manufacturing. Starting with steel tubes, components are developed and manufactured that simultaneously meet the extremely narrow dimensional specifications demanded in new drive and engine concepts, in connection with minimal wall thickness and optimized operative behavior. To date, the inlet and outlet funnels for catalytic converters have mostly been produced by expensive casting processes involving heavy weights. Starting from this financial year, the series production of such funnels is being carried out at OHC by way of hydro-forming.

In order to transport liquefied natural gas on large tankers instead of using pipelines, special transport containers are required for the freight that is compressed to 250 times atmospheric pressure. Each gas tanker uses up to 3,700 cylinders made from steel tubes, each of which is 37 meters long and weighs about 30 tons. Frequent changes in pressure due to filling and emptying require a particularly high resistance to material fatigue. In the innovative Hifa® Pipes made by Europipe GmbH this is achieved by optimizing the welded seams.

Thanks to ultra-high-strength tube grades such as X100 and above, it is possible to transport gas in large diameter pipelines under increased pressure. A further advantage of the tubes is the reduced welding input required in laying. However, the ductile concept used for lower-strength tube grades to



avoid longitudinal cracks can no longer be ensured for grades above X80. The design developed for Europipe, which uses crack-arrestors made from glass fiber wrapping located at regular intervals on the pipeline, meets the safety requirements for tubes used for both onshore as well as offshore purposes.

We have started a cooperation venture with the CORUS Group to develop high manganese content HSD® (High Strength and Ductility) steels. These ultra-high-strength steels are particularly suited for creating complex components and, thanks to their qualities, represent a quantum leap compared with conventional steels.

Further focal points of future research are the development of automotive lightweight design and engineering concepts and of ultra-high-strength and multi-phase steels. The first area comprises the SCALIGHT Project, in which, besides the Salzgitter Group, the full-service vehicle supplier and manufacturer Wilhelm Karmann GmbH as well as 2nd- and 3rd-tier suppliers are working together. As a group, they are developing new concepts for the efficient implementation of ultra-high-strength steels in car manufacturing. In the process, they particularly take into account the scalability of components for different vehicle series. The project serves as a technology platform for new developments by the Salzgitter Group.

We are developing additional new alloying concepts and adapted plant and system operation procedures for the high-strength and extremely high-strength multiphase steels that are already in successful use today, in order to place the market success of this group of products and quality grades on a broader foundation in the near future. The deployment of these steels enables significant weight savings in the transport sector.

Customer orientation, innovative capabilities and in-depth technology expertise are the key benchmarks of our R&D activity. These strengths create the basis for R&D's contribution to securing the future of the Salzgitter Group.

### Five-year Overview of Research and Development

<sup>1)</sup> R&D expenses in relation to Group sales

<sup>2)</sup> R&D expenses in relation to Group value-added

<sup>3)</sup> Reporting of research-related expenses from FY 2003

|  |        | FY 2005 | FY 2004 | FY 2003 <sup>3)</sup> | FY 2002 | FY 2001 |
|--|--------|---------|---------|-----------------------|---------|---------|
| Research and development expenses                | € mil. | 58      | 57      | 58                    | 47      | 48      |
| Research and development employees               | empl.  | 706     | 701     | 670                   | 400     | 400     |
| Research and development ratio <sup>1)</sup>     | %      | 0.8     | 1.0     | 1.2                   | 1.0     | 1.0     |
| Research and development intensity <sup>2)</sup> | %      | 2.9     | 4.2     | 5.3                   | 4.2     | 4.3     |

Impressive draft:  
The difference between an unloaded and loaded container ship is a good 15 meters.