

Leveraging its advanced technology capabilities in specialty steel, the Daido Steel Group has declared its management philosophy of “pursuing the potential of materials to support our future,” and conducts a proactive program of research and development (R&D) to expand new products and businesses and strengthen the foundations for existing businesses.

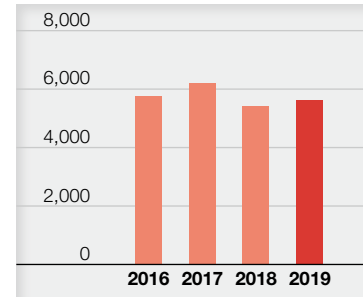
We are pursuing R&D for new products, materials and technologies, primarily through the Daido Corporate Research & Development Center. We employ a total of 303 researchers throughout the Daido Steel Group.

R&D expenses for the Daido Steel Group during the fiscal year under review amounted to ¥5,638 million. An explanation of our R&D efforts by segment, including purpose, major achievements, and expenditures follows.

## R&D EXPENSES

Years ended March 31

(millions of yen)



### (1) Specialty Steel

In this segment, R&D includes basic material development, such as automotive structural materials and tool steel, and process innovations ranging from steelmaking, refining and solidification to quality assurance.

R&D costs for the fiscal year under review in this segment totaled ¥1,593 million. The following is one of our major achievements in this area.

- **DHA-HS1 steel for hot stamping dies**

Hot stamping is a process that enables parts with ultra-high tensile strength exceeding 1 GPa to be manufactured by forming a steel sheet while it is extremely hot and then rapidly cooling it in the die. As the use of ultra-high tensile materials is increasing to make vehicles lighter, there has been a need for dies with wear resistance suitable for the cooling capacity and high temperature of the hot stamping process. Optimizing the composition of the steel enhances thermal conductivity and softening resistance and the cooling capacity and wear resistance of the die can be expected to improve. We aim to expand the adoption of DHA-HS1 by pressed parts manufacturers.

### (2) High Performance Materials and Magnetic Materials

In this segment, the Daido Steel Group conducts R&D focusing on developing materials that resist corrosion and heat, high-grade strip steel, welding materials, magnetic materials and electronic devices.

R&D costs for the fiscal year under review in this segment totaled ¥2,660 million. The following are some of our major achievements in this area.

- **DNM140-HCR, a high-strength stainless steel with outstanding corrosion resistance for non-magnetic drill collars**

In recent years, the environment for materials used in oil drilling has become more severe due to developments such as a shift from onshore to offshore drilling or drilling at increasing depths. This has resulted in a need for non-magnetic drill collars with higher corrosion resistance. DNM140-HCR stainless steel has received praise from North American oil service companies for providing outstanding corrosion resistance while maintaining a high strength. We have begun selling it as a high-strength and highly corrosion-resistant material for drill collars used in severe environments.

- **NCT, a sputtering target material for interconnection with protective layers for in-vehicle touch panels**

We developed NCT, an alloy target material for wire protection film that offers outstanding environmental resistance, which is required at high levels for in-vehicle applications. We designed it with an eye to touch panel displays, which are being increasingly used in automobile center consoles and navigation systems. Since NCT has superior corrosion resistance enabling wet etching and is non-magnetic, it offers high levels of productivity and suitability for our customers' deposition processes.

- **Neodymium magnet, free of heavy rare earth elements, also adopted for use in high-output, high-torque motors for mid-sized hybrid vehicles**

This plate magnet that Daido Electronics Co., Ltd., a member of the Daido Steel Group, manufactures using its proprietary hot deformation method has been adopted for use in a Japanese automaker's dual motor hybrid system for new hybrid vehicle models. This type of magnet has been used in compact hybrid vehicles since 2016. As a result of manufacturing process improvements, it has also been adopted for use in motors for mid-sized hybrid vehicles that require even higher levels of output and torque.

### **(3) Parts for Automobile and Industrial Equipment**

R&D in this segment concentrates on development of turbochargers, engine valves and other automotive parts, as well as parts for various types of industrial machinery.

R&D costs for the fiscal year under review in this segment totaled ¥1,253 million. The following is one of our major achievements in this area.

- **DSA760 certified for use in marine engine exhaust valves by world's largest manufacturer**

In July 2018, DSA760 obtained certification for use as a material for marine engine exhaust valves from the world's largest manufacturer of two-stroke diesel engines for marine use, which has a market share of just over 70%. This is the second certification for use, following that received in April 2016 from the biggest domestic marine engine manufacturer.

### **(4) Engineering**

Engineering R&D focuses on the development of environmental conservation and recycling equipment, and a variety of energy-saving industrial furnaces.

R&D costs for the fiscal year under review in this segment totaled ¥130 million.