

# Research and Development

## R&D ORGANIZATION AND CURRENT PROJECTS

The Daido Steel Group conducts a proactive program of research and development, underpinned by a solid technological capability based on specialty steel, in order to expand new products and businesses, and strengthen the foundations for existing businesses. During the fiscal year to March 2007 we established the Daido Corporate Research & Development Center, and pursued R&D for new products, materials and technologies, with work concentrated in the Special Steel Research Lab., Electromagnetic Material Research Lab., Process Technology Development Center, and Business Development Center. There are 227 researchers throughout the Daido Steel Group, and we intend to further increase the number of research personnel.

R&D expenses for the Daido Steel Group during the fiscal year under review amounted to ¥4,313 million. Going forward, we will concentrate our efforts in developing materials for growth markets, developing high-value-added products.

### R&D Focus

#### 1. Materials development for growth markets

Commercialize the achievements of the Next Decade Research Center, an R&D facility for medium to long-term research.

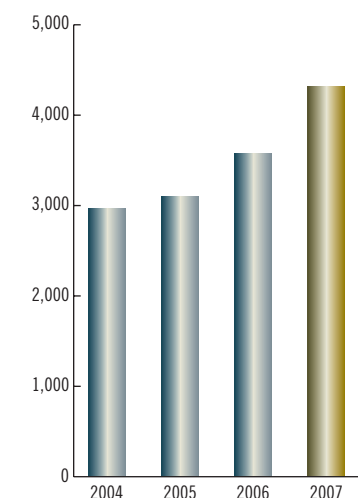
#### 2. Accelerate development of high-value-added products

High-strength, heat and corrosion resistance, low cost

#### 3. Focus on element research

Use of alternative elements and development that conserves elements

**R&D Expenditures** (Years ended March 31)  
(millions of yen)



## R&D RESULTS BY SEGMENT

### ❖ SPECIALTY STEEL

In this segment the Daido Steel Group conducts R&D covering all aspects of the specialty steel field, including development of such basic specialty steels as structural steel, heat and corrosion-resistant steel, and tool steel and welding materials, as well as process innovations ranging from refining to quality assurance and analytic technologies. R&D expenditures in this segment during the fiscal year under review amounted to ¥1,948 million.

### Major Achievements

#### ☆ *DEG Steel for vacuum carburizing*

Vacuum carburizing is attracting attention as a next-generation carburizing technology because it allows processing of high-strength components in a shorter period of time than conventional atmospheric carburizing. It also allows lower CO<sub>2</sub> emissions. However, it has a tendency for weakness in sharply-angled parts such as the edges of gear teeth, which has been an obstacle to widespread adoption.

Daido Steel has addressed this problem with the development of DEG Steel, produced by adjusting the components of the material in accordance with the basic theory of vacuum carburizing derived by Daido to prevent the loss of the strength in the angled parts. Compared to JIS-SCr420 (AISI 5120, DIN 16MnCr5) steel that has been vacuum carburized, the fatigue strength of DEG Steel is approximately 2.4 times higher, allowing for a significant improvement in strength of automotive parts.

Daido Steel's basic theory of vacuum carburizing has also been applied to simulation software for operating conditions, helping to enhance the performance of ModulTherm, the vacuum carburizing furnace manufactured by Daido.

### ❖ ELECTRONIC AND MAGNETIC MATERIALS

In this segment the Daido Steel Group conducts R&D focusing on magnetic materials and products for communications environments, working to develop new products and technologies. R&D expenditures in this segment during the fiscal year under review amounted to ¥325 million.

#### Major Achievements

##### ☆ *Expanding applications for hot-formed ring magnets used in electric power steering*

The main drive system for steering of automobiles today is hydraulic power steering, though electric power steering allows for better fuel efficiency. Daido Steel's hot-formed ring magnets are already being used as magnets for electric power steering motors, and we are further expanding their applications.

##### ☆ *DPR-NRC composite magnetic sheet for wireless communications*

RFID devices in the 13.56 MHz bandwidth experience a significant deterioration in transmission range when there is any metal near the antenna, as metal absorbs electromagnetic waves. To resolve this issue, Daido Steel has developed the DPR-NRC composite magnetic sheet, which is ideally suited to RFID at 13.56 MHz. A composite magnetic sheet interposed between the metal plate and the antenna prevents degradation of the signal. These sheets are currently being used in mobile phones.

\* RFID: Radio-frequency identification. A contactless recognition technology using wireless communications

### ❖ PARTS FOR AUTOMOBILE & INDUSTRIAL EQUIPMENT

In this segment, the Daido Steel Group conducts R&D for engine valve and various other automobile components, as well as for a range of parts for industrial machinery. R&D expenditures in this segment during the fiscal year under review amounted to ¥826 million.

#### Major Achievements

##### ☆ *DNM140 nonmagnetic, high-strength drill collar for resource excavation*

Drill collars are thick-walled tubular pieces that provide force to the bit when drilling such resources as oil or natural gas, and so need to be extremely strong. Steel is typically used to make the

drill collars, though nonmagnetic collars are used when it is necessary to measure the geomagnetic date. For such applications Daido Steel has developed the nonmagnetic drill collar DNM140, which is both high strength and highly resistant to stress corrosion cracking.

### ❖ ENGINEERING

In this segment, the Daido Steel Group conducts R&D mainly for environmental conservation and recycling equipment and a variety of energy-saving industrial furnaces. R&D expenditures in this segment during the fiscal year under review totaled ¥39 million.

#### Major Achievements

##### ☆ *Process for using carbonized sewage sludge to produce biomass fuel*

Carbides have traditionally been used as fuel for co-combustion with coal. Daido, however, has pursued development to raise the amount of potential heat from carbides, and has developed a production process to create a stable biomass fuel with over 30% more calories than traditional carbides. Demand from power stations and other fuel consumers for co-combustion fuels is expected to increase, and this technology can be expected to help increase sales.

### ❖ NEW MATERIALS

In this segment the Daido Steel Group conducts R&D mainly for such new materials as functional powder metals and titanium products. R&D expenditures in this segment during the fiscal year under review totaled ¥1,173 million.

#### Major Achievements

##### ☆ *Soft magnetic metal powder*

Manufacturers of the latest electronic devices have a pressing need for smaller electronic components, particularly for such consumer electronics as computers and flat-display televisions. The power transformers used in these products have traditionally used soft magnetic ceramics and similar materials, but this has been a hindrance to reducing their size. Daido has developed a soft magnetic metal powder that makes it possible to reduce the size of these transformers.