R&D and Intellectual Property Activities

Supporting the Kobe Steel Group, the Technical Development Group engages in basic and advanced research and works closely with the business segments. Kobe Steel's laboratories pursue the development of truly distinctive "Only One" products and ever higher levels of manufacturing excellence.

The Technical Development Group serves as the Group's R&D base, undertaking research to enhance the profitability of the business segments while pioneering new products and technologies for the future.

R&D Activities

Materials Research Laboratory

The Materials Research Laboratory (MRL) engages in research based upon four technological fields: refining and solidification, materials design, mechanical working, and surface control. For the materials business, MRL is working to develop new high-performance products based on material and surface design and control, and to optimize manufacturing processes. For machinery-related businesses, MRL focuses on creating differentiated products utilizing its expertise in materials. MRL also strives to develop new businesses based on high value-added products.

Mechanical Engineering Research Laboratory

The Mechanical Engineering Research Laboratory (MERL) conducts research and development in machinery, materials, the environment, energy, and steel structures. Through the use of advanced simulation, testing, measurement, and analysis techniques in the fields of structural, strength, dynamics, acoustics, fluids, thermal, combustion, and chemical technologies, MERL works to enhance product performance, improve production processes and design, and focus on developing new products and technologies.

Production Systems Research Laboratory

The Production Systems Research Laboratory (PSRL) actively innovates production technologies to strengthen the Group's manufacturing capabilities by utilizing cutting-edge technologies for instrumentation and inspection, control, production planning, information system and signal processing.

Electronics Research Laboratory

The core technologies of the Electronics Research Laboratory (ERL) include those related to thin-film materials, microfabrication and superconductivity. ERL plays a part in strengthening the Kobe Steel Group's business competitiveness in such growth fields as nanotechnology, the environment and energy. In addition, based on its electromagnetic design and electronic control technologies, ERL is making progress in the development of novel products in the power electronics field and making inroads into potential new businesses.

Coal & Energy Technology Department

The Coal & Energy Technology Department (CETD) is developing energy conversion technologies such as the upgrading of brown coal through dewatering and de-ashing, coal liquefaction, and the hydrocracking of heavy oil. CETD is working to find ways to effectively use the world's untapped natural resources and contribute to securing stable and diversified energy sources for Japan.

R&D-related Subsidiaries

- Kobelco Research Institute, Inc.
- Shinko Research Co., Ltd.

Recent R&D Achievements

Structural Analysis of Materials at Atomic Level Helps Create New Products and Technologies

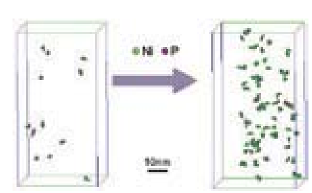
Kobe Steel has developed a method of atomic-level analysis of microstructures that determine the performance of metals. If the element distribution of a metal is clearly known, the cost of high-functional materials can be lowered and additional high-functional materials can be developed.

We have introduced a three-dimensional atom probe that can evaluate the cubic distribution of atoms. When metal to be examined is formed into a needle-like shape and high voltage is applied at an extremely low temperature, atoms on the surface of the sample become ionized and isolated. Using the varying time-of-flight that it takes for different elements to reach the detector, we can determine the three-dimensional distribution of elements in the metal sample.

So far, copper alloy used in terminals in cars has been examined using this technique. With demand for terminals growing due to more automobile electrical components, these alloys are being more frequently used in high-temperature environments such as engine rooms. Thus, more demanding levels of heat resistance are required to ensure terminal reliability. Through three-dimensional atom probe analysis, it was discovered that heat resistance varies substantially depending on the difference in the number of nickel and phosphorous clusters (atom aggregates) in the copper alloy.

Kobe Steel will continue to pursue R&D on developing high-strength steel, speciality steel, high-strength aluminum alloys and other products that contribute to creating lighter cars.

Three-dimensional atom probe



Nickel and phosphorous cluster mapping

Excavator Development Accelerates Energy-Savings

In recent years, with environmental problems emerging and calls for energy conservation, there has been a growing demand for fuel-efficient construction machinery.

The Mechanical Engineering Research Laboratory developed an analysis method based on SINDYS, a nonlinear dynamic analysis program developed by Kobe Steel, which can evaluate prior to test production the dynamic behavior and fuel consumption performance that occurs during the actual operation of a hydraulic excavator, a machine that intricately combines a hydraulically controlled system, a mechanical linkage system, and other systems. The lab also developed the HILS* evaluation technology, which combines the actual machine and analysis to evaluate performance. Through the application of these technologies, it was able to design and develop an efficient and effective low fuel consumption hydraulic excavator by selecting, effectively verifying, and improving measures proposed based on loss power contribution analysis during actual excavator operation.

Kobelco Construction Machinery's ACERA GEOSPEC, an excavator that complies with Tier III emission regulations, consumes 20% less fuel than existing excavators due to its complete reduction of hydraulic loss and optimized control of the hydraulic system and power source. We will develop additional energy-saving technologies with the goal of producing the next generation of energy-saving construction machinery.

* Hardware In the Loop Simulation: A technology that simulates with a high degree of accuracy the actual operating conditions of construction machinery on a benchmark testing machine by combining the actual machinery with the computer simulation, thereby enabling performance testing on individual machinery that approaches actual operating conditions.

ACERA GEOSPEC

HILS Performance Evaluation System

Aluminum Alloy Thin Film with Heat Resistance of 600ºC

We are developing new alloy materials including aluminum alloy thin film as wiring material for LCD display substrates. Kobe Steel had developed an aluminum-neodymium alloy thin film that is heat resistant at 400ºC and serves as an industry standard material.

In this very same market, high-resolution displays as typified by those used in smartphones have recently been attracting attention. To achieve such high resolution, our only option was to use a metal thin film with a high melting point, as the temperature of the display manufacturing process had risen and a heat resistance of 600ºC was required in the wiring material. However, there were problems in terms of the high electrical resistivity and high material cost of high-melting-point metal. To solve this problem, the Electronics Research Laboratory developed aluminum alloy thin film with a heat resistance of 600ºC and electrical resistivity of less than half that of high-melting-point metal. By effectively adding multiple elements in the aluminum, we were able to achieve a heat resistance of 600ºC and a low electrical resistivity of 5.3μΩcm, less than half that of molybdenum and one-fifth that of tantalum.

Currently, display manufacturers are already at the evaluation stage of these new alloys. With the development of this aluminum alloy thin film, we have shifted our focus beyond the field of displays and have begun expanding into wiring material for fluorescent vacuum tubes and electrode material for power semiconductors. We will continue expanding into other fields where high-melting-point metal thin film is used.

Intellectual Property Activities

IP Management at the Product, Technology Level

Strategic intellectual property activities are essential to the Kobe Steel Group's rigorous pursuit of high-end "Only One" products, one of the basic policies of KOBELCO VISION "G." In recent years, the importance of intellectual property has been growing and making it necessary for business divisions, R&D units and intellectual property departments to cooperate in a "barrier free" way, promoting communication throughout the Group. Further, there have been calls for a response to the increasing problems of counterfeit products in Asia and higher incidence of technological leakage from companies.

Amid this environment, the Group's IP activities have revolved around (1) promoting intellectual property management; (2) strengthening its global response; and (3) improving cooperation in the area of intellectual property throughout the Group. Most importantly, with regard to intellectual property management for individual products and technologies, we are moving forward on utilizing a new intellectual property management system and constructing a patent network in Japan and abroad.

Overview of Fiscal 2010

In fiscal 2010, Kobe Steel received nearly 620 new patents in Japan, primarily to protect "Only One" products, which now gives the Company approximately 4,500 total patents. Moreover, as a result of the globalization of its business, Kobe Steel is strengthening its application of new patents overseas, especially in Asia, which now account for almost 30% of its total number of patent applications.