R&D Achievements

Hitachi Metals Group continuously invests in R&D on advanced materials that contributes to sustainable growth and social contribution, particularly in regard to strengthening the creation of new businesses and products that contribute to an environmentally friendly society. And we are shortening the development period by utilizing digital technologies such as AI and materials informatics.

In 2021, our group invested 12.4 billion yen in R&D, and our R&D activities produced the results listed below. As for our future R&D activities, we will contribute to environmental and social issues such as product-weight reduction, fuel efficiency and energy conservation, and decarbonization in industrial infrastructure and electronics-related fields as well as automotive-related fields, where the shift to electrification (xEV)*1 is expected to continue.

*1 The generic term for electric vehicles (EVs), hybrid electric vehicles (HEVs), and plug-in hybrid electric vehicles (PHEVs).

Special Steel Products

- As a copper alloy for relay terminals of batteries for xEVs, HZR150 has both high strength and excellent electrical conductivity. It suppresses heat generation due to electrical resistance when energized and reduces the risk during welding of movable and fixed terminals.
- As a clad material for power modules, Cu/36Ni-Fe/Cu clad metal has a low thermal-expansion coefficient and high thermal conductivity. It can be used in the parts such as leads, thermal-stress buffers, and heat spreaders in a manner that helps to improve the performance of next-generation power modules.
- L-Frex®H is a physical-vapor-deposition (PVD) coating for cold-aluminum-pressed products with excellent durability. Its maximum hardness is approximately 4000 HV, which is top class among hydrogen-containing diamond-like carbons (DLCs). It is expected to improve the mold life in aluminum-press applications such as door-panel peripheral parts that conventionally cannot be molded due to galling.
- DAC®-X, a die-casting mold steel with both high-temperature strength and toughness, combines an alloy design that produces high-temperature strength with a steel-grade-independent process for controlling microstructure. It has excellent heat-cracking resistance, which results in longer mold life. It also contributes to reduced work hours for die repair and improved productivity and quality even in the case of high-cycle casting of die-casting products.
- SLD®-f, a cold-die steel, achieves highly efficient machinability (about 3.5 times higher than that of SKD11 under standard cutting conditions) through a composition that generates belag*2 and refines coarse carbides. It helps our customers to increase cutting speed and reduce die-machining time.

*2 Oxide-based deposit formed on the rake face of a tool during cutting. Formation of belag provides lubrication and reduces tool wear.

Forged Products

- BU1FWBL-E is an explosion-proof, electrically operated segmented-ball valve, with variable open/close speed, that can be used in explosive atmospheres such as chemical plants. Timing of its opening and closing can be set individually, and it has a function for monitoring valve status. Thanks to these features, it contributes to lower construction and operating costs.

Magnetic Materials and Power Electronics

- Based on our newly developed microstructure-control technology, the NMX-G1NH series of rare-earth magnets achieves higher performance while using much lower amounts of heavy rare earths than conventional magnets. We expect it to contribute to scaling down of motors (including motors for xEVs) and increasing their efficiency while reducing the risk of procuring rare elements.

Electric-wire Materials

- An “wear-detection system with optical-fiber-equipped trolley wire” has been successfully commercialized in collaboration with Central Japan Railway Co., Ltd. Real-time monitoring of wear of a trolley wire helps prevent problems before they occur, and even if a wire breaks, it is easy to pinpoint the location of the breakage. This system reduces maintenance-work hours concerning railway infrastructure and helps to promote “smart infrastructure.”

Global Research & Innovative Technology center (GRIT)

Topics 1

2022 National Commendation for Invention **“Invention Prize”**

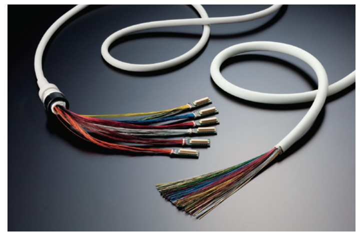
Awarded Invention

“Invention of ultra-fine copper-alloy wire and products applying it”

Inventor

Hiromitsu Kuroda and Huang, Yue Tian — Advanced Components & Materials Division, Wire & Cable Department Hitachi Metals, Ltd.

Ryohei Okada — Electric Material Production Department



Probe cable for medical equipment

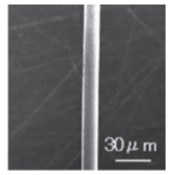
Ultrafine copper-alloy wire that combines high strength and high conductivity at a level not hitherto achievable

In general, when a wire becomes thin, it becomes easy to break, and it is difficult for electricity to flow. Based on a copper-silver alloy that contains 1 to 3% by weight of silver in copper, the developed ultra-fine copper-alloy wire is used in ultra-fine wire conductors. In particular, after the copper-silver alloy is drawn into an ultrafine wire, distortion of the metal structure is controlled by a special heat treatment. As a result, the wire combines high strength and high conductivity at level hitherto unachievable.

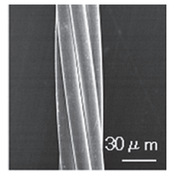
When this ultrafine copper-alloy wire is used in ultrafine coaxial cables, it makes it possible to reduce the cable diameter by approximately 20% (e.g., from 0.205 to 0.165 mm) compared to the diameter of conventional cables while maintaining high strength characteristics and electrical conductivity, and a multi-core cable using this ultrafine coaxial cable has an approximately 30% smaller diameter than conventional cables.

This ultrafine copper-alloy wire will enable minimally invasive medical devices*, high-definition imaging, and improved operability in such a manner that contributes to reducing the burden on patients. And responding to social needs, we expect it will be used as a signal-transmission cable for information devices such as smart phones and wearable devices.

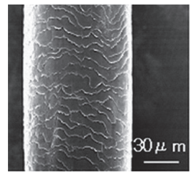
*Minimally invasive: reducing the physical burden and impact on the body.



Single wire (0.013-mm diameter)



Stranded wire (0.013-mm diameter × 7 wires)



Reference: human hair

Topics 2

2021 Cho-Monodzukuri Parts Grand Prize, **Japan Strength Award**

Award-winning Components

Medical Silicone Cable SilMED®

The medical-use silicone cable SilMED® developed by Hitachi Metals has improved sliding performance and chemical resistance while maintaining the mechanical and transmission characteristics and wipe resistance of conventional silicone cables thanks to its unique surface coating that creates an uneven surface. Its coefficient of static friction is reduced to approximately 20% of that of conventional cables to improve sliding performance. We commercialized it in 2020, and it has already been adopted as a probe cable for ultrasonic diagnostic equipment.

Demand for chemical resistance in regard to medical equipment has been increasing owing to the COVID-19 pandemic, and SilMED® is being used in a variety of medical devices such as power cables for endoscopes and catheters.

At the Award Ceremony on November 26, 2021

Medical silicone cable SilMED®

Topics 3

SIMTech and Hitachi Metals expand their joint laboratory, and they have started developing materials for metals 3D additive manufacturing.

(SIMTech), a research institute of the Agency for Science, Technology and Research of Singapore, and Hitachi Metals Singapore Pte. Ltd., (Hitachi Metals hereafter) will extend the period of their research and development at the SIMTech-Hitachi Metals Additive Manufacturing Lab for three years, expand the lab’s functions, and research and develop metal powders for additive manufacturing with the aim of providing a new solution for 3D additive manufacturing in Singapore.

Currently, commercial metal powders used for 3D additive manufacturing are not optimized for additive manufacturing. By customizing them for 3D additive manufacturing and developing metal powders for 3D additive manufacturing for fields such as aerospace, automobiles, energy, and semiconductors, we hope to significantly contribute to the rapid progress of 3D additive manufacturing of parts.

By combining Hitachi Metals’ expertise in materials with SIMTech’s advanced manufacturing-process technology, we have established manufacturing processes and quality-evaluation methods for mass production of parts by 3D additive manufacturing. Over the next three years, we will further develop the technology we have developed so far and improve the metal-powder-atomization process using metal-powder manufacturing equipment (i.e., gas atomizer) in a manner that improves the yield and quality of metal powder for 3D additive modeling and 3D-additive-modeled parts.