

Superconducting Technology in Furukawa Electric Group



Akira Fujisaki*

In order to build a sustainable world and make people's life safe, peaceful and rewarding, Furukawa Electric Group will create solutions for the new generation of global infrastructure combining information, energy and mobility. This is the Furukawa Electric Group Vision 2030 established in 2018, which shows the visionary outlook that Furukawa Electric aims to achieve by 2030. Since then, our R&D has strengthened our core businesses and supported their transformation. It has also promoted the creation of new businesses that solve social issues that work by combining our core businesses.

The theme of this issue of Furukawa Electric Review is superconducting technologies. These are important technologies that we have been working on since the first half of the 1960s. And they are at the core of the energy sector, which aims to achieve carbon neutrality in the Medium-term Management Plan announced in May 2022. Superconducting technologies are garnering more and more attention as important technologies for building core energy infrastructure in order to realize a sustainable society in the future.

Superconductivity is a phenomenon in which the electrical resistance becomes zero below a certain temperature, which is known as the critical temperature. If wires are made of materials that exhibit this phenomenon, huge electric currents can be conducted without energy loss. And by winding coils using superconducting wires, ultra-strong electromagnets not possible with conventional copper wires can be realized.

The discovery of the Higgs boson, which led to the Nobel Prize in Physics in 2013, was carried out using the Large Hadron Collider at the European Organization for Nuclear Research (CERN) in Geneva, Switzerland. The core components of the accelerator—ultra-high magnetic field electromagnets—were made from niobium-based metal superconducting wires, which are low-temperature superconducting wires from Furukawa Electric based on our metal technologies developed at Nikko Works such as oxygen-free copper and stranding technologies.

In addition to academia, superconducting wires are already playing critical roles in various industrial sectors. These include: magnetic resonance imaging (MRI) diag-

nostic equipment in the field of medicine; nuclear magnetic resonance (NMR) equipment in the fields of food safety, drug development, and virus analysis; next-generation high-speed transportation systems using magnetic levitation; and crystal growth equipment in the field of semiconductor manufacturing. Products using superconducting coils with strong magnetic fields, such as nuclear fusion, have been put into practical use, and we are moving forward with the development of further next-generation products.

The high-temperature superconductivity phenomenon was discovered in the 1980s, and the commercialization of such wire materials was realized in the early 2000s. Further improvements in performance continue to be made. Furukawa Electric's 100% US subsidiary SuperPower Inc. (SPI) is developing and commercializing this oxide high-temperature superconducting wire material. With the completion and operation of a new plant in 2020, SPI has begun to further accelerate its efforts to increase the performance of its wire materials and expand its mass production capacity. In 2022, Furukawa Electric and SPI signed a memorandum of understanding with Tokamak Energy Ltd. in the UK, and began supplying high-temperature superconducting wire materials to be used in the development and prototyping of compact fusion reactors led by Tokamak Energy.

Tokamak Energy has a mission to deliver clean, sustainable, low cost, and globally available energy through the early realization of commercial fusion reactors. This is consistent with the social issues and solutions outlined in the Furukawa Electric Group Vision 2030. We are a rare company globally that possesses both low-temperature and high-temperature superconducting wire material products. And by taking advantage of this unique position, Furukawa Electric will continue to take on new challenges in the next stage of research and development in order to further develop superconducting technologies.

We are pleased to present this special issue, which highlights the potential of our Group's superconducting technologies.

We hope you will take a look and enjoy the contents.

* Corporate Vice President, General Manager, Research & Development Division