

Recent Progress of Superconductivity and Cryogenic Engineering in Japan and Future Prospects as Key Technologies for Realizing Carbon Neutral Society

Shirabe Akita

Central Research Institute of Electric Power Industry (CRIEPI), Japan

E-mail: akita@criepi.denken.or.jp

Abstract—In Japan, the development of superconducting application equipment continues to progress, with LTS conducting research and development aimed at practical application, and HTS progressing with the development of magnets for generating high magnetic fields such as NMR. In parallel with these efforts, research is progressing on methods for detailed analysis of the performance of high-temperature superconducting wires.

On the other hand, the use of hydrogen is the key to realizing a carbon-neutral society, and progress is being made in considering the introduction of liquid hydrogen. Since liquid hydrogen can also be used to cool superconducting equipment, Japan has begun considering a liquid hydrogen superconducting complex that would combine a large-scale liquid hydrogen import base with various superconducting application equipment. As specific equipment, research has begun on a superconducting motor-driven pump for liquid hydrogen and a superconducting generator cooled by liquid hydrogen. Meanwhile, research is progressing to make MgB₂ wires that can be cooled with liquid hydrogen to ultra-thin wires down to 15 μm in order to use them in alternating current.

Keywords (Index Terms)—High field magnet, NMR over 1 GHz, Compact cyclotron, evaluation technology, liquid hydrogen, SC Complex, MgB₂ wire for AC use, HTS motor for LH₂ pump, LH₂ cooled generator