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Recent Works of MgB_2 and MgB_2 Wires, and Current Status of Power Applications using BSCCO Wires in Japan

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In Japan, the research and development of superconducting wires are being performed extensively in universities, public organizations, and industries for both high temperature oxide superconductors (HTSC) and low temperature metallic superconductors (LTSC). Fundamental researches on various physical properties related to critical current density J_c are being carried out in several universities. Public organizations such as NIMS and ISTEC-SRL have been developing various processes for superconductors and are deploying them into commercial base having collaboration with companies. Particularly, ISTEC-SRL is showing a strong leadership to industry to develop YBCO coated conductors.

Our NIMS(formerly NRIM) has a long history of developing superconducting wires from the age of LTSC and made several remarkable contributions in the developments of intermetallic superconductors such as the invention of bronze process. Therefore, NIMS has a strong interest in the MgB_2 as a new member of intermetallic compound superconductors. Immediately after the announcement from Prof. Akimitsu, we succeeded to synthesize MgB_2 bulk materials with ideal density and reported that the upper critical field H_{c2} is 18T at 0K. More precise measurement of H_{c2} using our single crystal showed that the anisotropy factor of H_{c2} is 2.6-3.0, which is much smaller than that of HTSC. We fabricated tapes and wires by powder-in-tube method without sintering using various metal tubes as sheath materials. The highest J_c obtained so far is $4x10^5 A/cm^2$ at 4.2K, which was achieved by using stainless steel tube. The tensile test showed that the tape has a high durability to the strain, I_c degradation occurring at 0.5% strain. In this talk, the possibility of practical applications using MgB_2 wires is discussed.

NIMS is now intensively working on conductors for high field superconducting magnets, which will be used for high resolution NMR spectroscopy and magnetic separation system. Bi-2212 is one of the most promising materials for high field generation well over 20T at 4.2K. We have been carrying out an extensive work to optimize the processing parameters, investigating the relationship between the microstructure and transport J_c. The highest J_c obtained so far is $5X10^5 A/cm^2$ at 4.2K and 10T. Scale-up production in kilometer length and the construction of prototype superconducting magnets are being carried out by the collaboration with companies.

In Japan, the production of long Bi-2223 tape is performed by several companies, most intensively by Sumitomo Elec. The tapes are being used for several prototype power application systems such as 100m transmission cable, a magnet for Si single crystal growth, magnetic separation system and so on. In this talk, the current status of these applications of Bi-2223 is also presented.