

Fabrication of 1m Long Multi Superconducting Layered Coated Conductor for High Engineering Critical Current Density

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Abstract - Cable conductors made by bundling of coated conductors to increase transport current have been developed in order to apply for the huge electric applications such as high magnetic field magnets, large accelerators and fusion reactors. Various kinds of cable conductors (CORC cable, Roebel cable, TSTC and round wire) have been fabricated using coated conductors, but these cable conductors do not have higher engineering critical current densities (J_e) for high performance of large applications. In this study, new multi HTS layered conductors have been fabricated to increase the critical current and J_e of the coated conductor as a wire of a cable conductor. Easy exfoliation property due to the weak c-axis strength of coated conductor is applied to make multi HTS layered conductors. In order to stack and bond multi-HTS layers on one substrate (MHOS), Ag diffusion bonding technique using only Ag plated coated conductor is adapted. MHOS conductors consist of multi biaxial textured superconducting layers without any intermediate epitaxially grown buffer layer or solder layer between the superconducting layers. Finally, by a newly invented fabrication process, a 1m long 4-MHOS conductor has been successfully fabricated, which shows higher critical current (2,484 A/12mmw) and a high engineering critical current density ($J_e = 0.12\text{MA}/\text{cm}^2$). The critical current of the MHOS conductor at LN2(65, 77K), and magnetic fields from 0 to 6 Tesla is increased proportionally to the number of superconducting layers.

Keywords (Index Terms) – HTS, coated conductors, critical current, engineering critical current density, MHOS, fusion, accelerator magnets, superconducting magnet.

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