[Invited talk]

Resistance-Free Joint for GdBCO-Coated Conductors

Haigun Lee [a], Yeonjoo Park [a], Yoon Hyuck Choi [a], Myungwhon Lee [b], and Youngkun Oh [b]

[a.] Department of Materials Science and Engineering, Korea University, Anam-dong, Seongbuk-gu, Seoul 136 - 713, Korea
+82-2-3290-3820, +82-2-928-3584, and haigunlee@korea.ac.kr
[b.] KJoins Co., Ltd., Seoul, Korea

Abstract: Here, we briefly report the recent progress of the world's first resistance-free joint, termed the "superconducting joint," for 2G GdBCO CCs. Our superconducting joint, which was based on atomic diffusion in GdBCO with partial melting and oxygen diffusion into the oxygen-deficient GdBCO lattices, did not resist the flow of electricity between the CCs, thus facilitating a perfect electrical connection. The joint between the CCs showed the following excellent electrical and magnetic properties: 1) no degradation in the critical current over the superconducting joint, and 2) no decrease in the initially induced magnetic field of the model GdBCO coil containing a superconducting joint. Moreover, a recent study demonstrated laser drilling into the substrate layer of the GdBCO CC to be more favorable for producing the microholes, and an etching process after laser drilling was preferable to laser drilling after elimination of the Ag stabilizer. The microholes promoted oxygen in-diffusion into the GdBCO layers, which resulted in reduced recovery time for the superconductivity during joining. The self-field critical current of the joined samples increased with increasing oxygenation annealing time, and the superconductivity of the joined sample eventually recovered in full after laser drilling, melting diffusion, and oxygenation annealing. Consequently, this unique joining technique can resolve the technical difficulties related to the lengthening of the 2G HTS CCs, and more importantly, overcome the difficulty in establishing a superconducting closed loop for persistent-current-mode operation.

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