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Low resistance soldered joint of REBCO coated conductors with novel Ag-dispersed structure

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Though low resistance joint is important technology for persistent current operation of HTS magnet system, superconducting joints of REBCO wires require direct epitaxial growth between REBCO surfaces that can only occur in high temperature procedure. On the other hand, at 4.2 K operation, even conventional solder spliced joints of coated conductors should have quite low joint resistance if low enough interfacial resistance was obtained, because resistances for both solder and Ag metal themselves should be negligible. But usually the interfacial resistances between REBCO and sputter deposited Ag protection layer are 10^{-11〜-12} Ω·m² at wide temperatures for typical coated conductors.
We deposited deeply Ag-doped REBCO films of 0.5˜2.0 μm thick by hot-wall pulsed laser deposition (PLD) method on 12 mm wide and 50 μm thick Ni-Cr alloy tapes with IBAD templates. Ag protection metal films of 2.0 μm thick were deposited on them by sputtering. Lap or bridge Joints of those tapes were made just by soldering. Joint resistances were measured by DC 4 probe method at 77 K and by loop current attenuation at 4.2 K. Microscopic structure was evaluated by XRD and SEM. Metal Ag particles were clearly dispersed in c- and a-axes oriented REBCO films. Jc of those REBCO films ranged from 0.2˜1.8 MA/cm² at 77 K, 0 T. Joint resistance was measured as 0.9˜1.1x10⁻¹² Ω·m² at 77 K, and 1.6˜2.8x10⁻¹³ Ω·m² at 4.2 K. Double layer structure of a thin Ag-doped REBCO film on a high-Jc 2.5 μm thick REBCO film had also low joint resistance without spoiling high-Jc properties. The results indicate a possibility to make low resistance joint of 10⁻¹² Ω just by soldering of commercial REBCO coated conductors.

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