

Heating and Loading Process Improvement for Indium Inserted Mechanical Lap Joint of REBCO Tapes

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Abstract— A mechanical lap joint of REBCO high-temperature superconducting (HTS) tapes with an indium foil inserted between joint surfaces has been proposed for segment-fabrication of HTS magnet of an advanced fusion reactor and various HTS applications. In a previous study, we successfully achieved a joint resistivity of about $3.5 \text{ p}\Omega\text{m}^2$ by heat treatment during fabrication of the joint. In this study, improved heat treatment method is developed by controlling contact pressure and combining bake-out process. During the development, we evaluated joint resistance and critical current of the joint depending on the heating condition and bake-out condition. For example, the joint resistivity after heat treatment was $2.5 \text{ p}\Omega\text{m}^2$ without decreasing critical current for a joint sample with conditions of heating temperatures of 90-140 °C, heating time for 30 minutes, contact pressure of 100 MPa and bake-out time for 30 minutes. The method proposed in this study, applying contact pressure during the heating, can increase true area of the contact surface and decrease the thickness of the indium greater than the previous method owing to applying contact pressure when the indium becomes softer. The contact resistance also decreased progressively according to increase of the bake-out time due to an increase of releasing gases.

Keywords (Index Terms)— Fusion reactors, high-temperature superconductors, power cable connecting, superconducting magnets.

IEEE/CSC & ESAS SUPERCONDUCTIVITY NEWS FORUM (global edition), January 2017 (Preview 2).
Submitted September 24, 2016; Selected November 26, 2016. Reference ST564; Category 6.
This ASC 2016 manuscript 4LPo1C-01 was submitted to *IEEE Trans. Appl. Supercond.* for possible publication.