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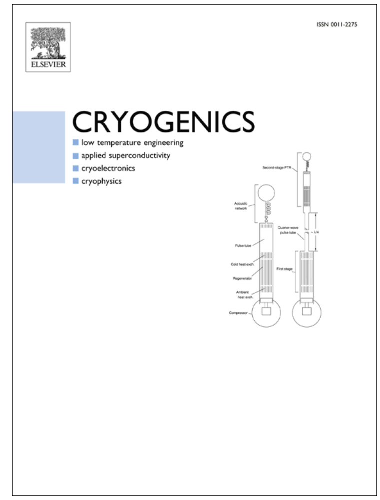

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Comparison between Bi-2223 Tape and RE-123 Coated Conductor from the View Point of Current Transport Properties Influencing Thermal Stability

Takanobu Kiss[1)] *, Masayoshi Inoue[1)], Kohei Higashikawa[1)], Takumi Suzuki[1)], Lin Lyu[1)], Ken Takasaki[1)], Kazutaka Imamura[1)], Yuta Onodera[1)], Dai Uetsuhara[1)], Akira Ibi[2)], Teruo Izumi[2)], Hitoshi Kitaguchi[3)]

[1)] Department of Electrical Engineering, Kyushu University, 744 Motooka, Fukuoka 819-0395, Japan

[2)] ISTEC-SRL, 3-2-1 Sakado, Takatsu-ku, Kawasaki-Shi, Kanagawa, 213-0012 Japan

[3)] National Institute for Materials Science, 1-2-1 Sengen, Tsukuba, Ibaraki 305-0047, Japan

Abstract: We have investigated flux flow dissipation in typical two kinds of HTS tapes, i.e., a Bi-2223 multi-filamentary tape and a RE-123 coated conductor (CC) from the view point of heat load under over current conditions. Based on systematic measurements on current-voltage characteristics, the nonlinear flux flow dissipation has been described analytically by taking into account current sharing in metallic sheath or stabilization layer. Flux flow dissipation in the RE-123 CC shows much steeper temperature dependence than that of the Bi-2223 tape. As a result, attainable cooling power becomes smaller in the RE-123 CC in comparison with that of Bi-2223 tape even if the same cooling condition. In other word, acceptable temperature rise in the RE-123 CC is small at over current condition, whereas moderate temperature dependence in the Bi-2223 tape allows stable operation even if the bias current exceeds the critical current. Influence of spatial inhomogeneity in the both HTS tapes has also been investigated. Longitudinal variation of local critical current, I_c, and its statistical behavior have been characterized by use of reel-to-reel scanning Hall probe microscopy. It has been found that the flux flow dissipation is possibly localized more than one order higher than that of the average value due to discrete local I_c drops.

Keywords: flux flow dissipation, critical current, spatial inhomogeneity, statistical distribution, Bi-2223 multi-filamentary tape, RE-123 coated conductor
Corresponding author*: kiss@sc.kyushu-u.ac.jp

1. Introduction

Acceptable dissipation level becomes large in a high T_c superconductor (HTS) because of its large heat capacity at an elevated operation temperature. Rounded current-voltage, *I-V*, characteristics also make the boundary between zero resistive state and dissipative state broad. As a result, heat balance between cooling and dissipation becomes more essential rather than a simple electric field criterion to determine thermal stability in the HTS. Namely, not only critical current, I_c, but also *I-V* characteristics at dissipative state becomes relevant to understand optimal cooling conditions and/or the behavior of thermal instability and switching characteristics of superconducting fault current limiters under over load conditions. However, such dissipation in a HTS tape shows non-linear dependence as a function of bias current, magnetic field and temperature in a complicated manner. Spatial inhomogeneity is also an important factor to determine thermal stability, however, the influence of local I_c variation is not yet fully understood in the HTS tapes because standard characterization techniques in a macroscopic scale cannot detect such local variation. In this study, we