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Critical Current Density in GdBa₂Cu₃O_{7-δ} Coated Conductor under the Influence of Flux Creep

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Critical current density, J_c, of Gd₁Ba₂Cu₃O_{7-δ} (GdBCO) coated conductor (CC) under the influence of flux creep is one of the most important issues for the design of superconducting magnet applications because the flux creep affects field homogeneity and stability in the magnet. Namely, magnetic moment induced in the tape strands becomes much larger than the case of conventional round wire because of its flat and wide surface. We should also take into account angular dependence against external magnetic fields. In this study, we have carried out magnetic moment, *m*, measurements at 77 K for GdBCO CC under external magnetic field conditions including inclined external field by use of vector SQUID MPMS. From the relaxation of *m*, electric field (*E*) vs. current density (J) characteristics at low electric field ranges from 10^{-10} to 10^{-9} V/m have been estimated. Combining these results with the four-probe transport measurements, we have successfully obtained wide-range *E*-J characteristics from 10^{-10} to 10^{-2} V/m. Extending the analysis of transport measurements in the range of 10^{-4} to 10^{-2} V/m within a framework of the percolation transition model, we also obtained analytical expression for the *E*-J characteristics which can cover both flux creep and flux flow regime. From the comparison between the experimental data and the analytical expression, it is clarified that the flux creep can be estimated from flux flow property measured by the transport measurements. J_c in inclined external magnetic field will also be discussed.

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