

Correlations between critical current density profiles and microstructures in various superconducting coated conductors

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The magnetic flux profiles near surfaces of various superconducting coated conductors (CC) under applied magnetic fields were measured using scanning Hall probe (SHP) method and magneto-optical image (MOI) method. These CC samples are classified by two categories; granular structure and pinning structure. The CC samples fabricated by using IBAD texturing and RABiTS texturing have the granular sizes of several tens of nano-meters and several tens of micro-meters, respectively. The CC samples fabricated with and without additional ZrBaO₃ have rod-type pinning centers (RPC) and no RPC, respectively. The magnetic flux profiles in these samples showed considerably different features. The current profiles, which were numerically calculated from the magnetic flux profiles using inversion method, also show clear differences correspondingly. The magnetic field dependences of critical current densities of these CC samples were measured by using I-V measurements while the magnetic fields were applied in various orientations with respect to the sample surfaces. The correlations between the anisotropic field dependence of critical currents and the magnetic flux profiles measured using SHP and MOI were observed. We found that the main factors to determine the features of flux profile are the field intensity dependence and the field angle dependence of the critical current densities. We found that these properties are due to the fact that the distributions of vortex densities, vortex orientations, and vortex structures in these superconducting films basically depend on microstructure of these various CC samples.