Microstructure and pinning in high-T_c and large-J_c (Nd,Eu,Gd)123 superconductors prepared by the OCMG process

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Abstract

We have studied vortex pinning characteristics of (Nd, Eu, Gd)-Ba-Cu-O composites with (Nd, Eu, Gd)$_2$BaCuO$_5$ and Pt additions. Microstructural observations with scanning electron microscopy clearly indicated that the Pt addition is effective in refining the (Nd, Eu, Gd)211 second phase particles, which led to a dramatic increase in J_c in low fields as well as in a high field region. The sample (Nd, Eu, Gd)Ba$_2$Cu$_3$O$_y$ added with 40 mol % second phase (Nd, Eu, Gd)211 with 0.5 mol % Pt exhibits a large critical current density of 60,000 A/cm^2 at 77K in 3T for the field parallel to the c axis. Such a high J_c value is attributed to extremely fine (Nd, Eu, Gd)211 second phase particles distributed in the (Nd, Eu, Gd)123 matrix with their average size as small as 0.1 μm.

We propose that J_c at relatively higher fields is possibly due to improved field induced pinning centers caused by the composition fluctuation, which are enhanced by mixing several rare earth elements.