

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)₂BaCuO₅ 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)Ba₂Cu₃O_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/cm² 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 μ m.

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.