A Novel Method to Detect Oxygen Vacancies in the Grain Boundaries of High-Tc Superconductors

TAKAHIRO TOMITA, JAMES S. SCHILLING, Department of Physics, Washington University, St. Louis, MO, LIHUA CHEN, BOYD W. VEAL, HELMUT CLAUS, Materials Science Division, Argonne National Labs — A new diagnostic method is introduced (pressure-induced $J_c$ relaxation) which is capable of detecting oxygen vacancies in the grain boundaries of oxide superconductors. A series of bicrystalline rings of YBa$_2$Cu$_3$O$_x$ containing single [001]-tilt grain boundaries with mismatch angles from 0 to 31 degrees are studied. Even for samples with nearly optimal doping in the bulk, a significant oxygen deficiency in the grain boundary region is revealed. In addition, compressing the grain boundary region is found to lead to a considerable enhancement of the critical current density $J_c$.


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