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EFFECTS OF GRAIN SIZE AND GRAINBOUNDARY ON CRITICAL CURRENT DENSITY OF HIGH-T_c SUPERCONDUCTING OXIDES

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By means of adding impurity elements in high-T_c oxides, we have studied the effects of grain size and grainboundary on the critical current density of the following systems: $YBa_2Cu_3O_{7-y}$ and Bi-Pb-Sr-Ca-Cu-O. In order to only change the microstructure instead of the superconductivity of the grains in the samples, the impurity elements were added into the systems in terms of the methods like this: 1) substituting Y with the lanthanide except Pr, Ce and Tb in $YBa_2Cu_3O_{7-y}$ system to finning down grains in the samples, therefore, we can investigate the effect of the grain size on the critical current density of 1:2:3 compounds; 2) mixing the high-T_c oxides with the metal elements, such as Ag, according to the comsition of (high-T_c oxide)$_{1-x}Ag_x$ to metallize the grainboundaries in the samples, studying the effect of the electric conductivity of the grainboundaries on the critical current density; 3) adding SiO_2, PbO_2 and SnO_2 into the high-T_c oxide to form impurity phases in the grainboundaries, trying to find out the effects of the impurity phases or metalloid grainboundaries on the critical current density of the high-T_c superconductors. The experimental results indicate that in the case of the presence of the metalloid grainboundaries finning down grains fails to enhance the j_c, but restrains it strongly, the granular high-T_c superconductors with the small size grains coupled weakly is always the low j_c system. On the contrary, the systems with the grainboundaries metallized display striking improvment in the superconducting current-carrying properties. Mixing SiO_2, PbO_2 or SnO_2 with high-T_c oxides can clean the brainboundaries, making the j_c increase. The optimal method of improving the practical properties of the oxide superconductors is discussed.