EFFECT OF NEUTRON IRRADIATION AND OXYGEN DEFICIENCY ON CRITICAL CURRENT IN HTSC MATERIALS

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Our understanding of the mechanisms which control J_c is not yet sufficient, even with respect to conventional type II superconductors. In the case of HTSC compounds the situation seems to be much more complicated since, in principle, any defects with sizes comparable to the coherence length ξ could play the role of pinning centers. Because ξ is of the order of nanometers or below, a large variety of structural defects could contribute to the pinning mechanisms. In this work we compare the influence of two types of defects — induced by neutron irradiation and/or induced by annealing — on critical currents of HTSC materials. Neutron irradiation is a very useful method which enables one to introduce defects into the whole volume of material in a controlled way. On the other hand, because of essential difference between YBCO samples with different oxygen content it also seems to be interesting to study oxygen deficient samples. Since it is very difficult to prepare oxygen deficient single crystals with homogeneous oxygen content, the majority of discussed results were obtained on melt–textured samples of YBCO. It was found that the oxygen vacancies induced by heat treatment are not effective pinning centers, because the critical current systematically decrease with increasing oxygen deficiency. The critical currents were studied for magnetic fields perpendicular and parallel to (a,b) plane before and after fast neutron irradiation with fluence from 10^{16} to 10^{18} n/cm^2 ($E > 0.5$ MeV). Properties of YBCO melt-textured samples are compared with properties of single crystal and ceramic samples. Influence of irradiation on non-superconducting Y, Bi, and La-based cuprates is also discussed.