

Dependence of the Structural, Electrical and Magnetic Properties of YBa₂Cu₃O_{7-δ} Bulk Superconductor on the Sm Doping

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Abstract : In this study, we report the synthesis and characterization of YBa₂Cu₃O_{7-δ} (YBCO) high-temperature superconductor prepared by solid-state method and doped with Sm in different weight percentages, 0, 0.01, 0.02 and 0.05 wt. The result of X-ray diffraction (XRD) analysis conforms to the formation of an orthorhombic phase of superconductivity in our samples. This is an important finding and indicates that the samples may exhibit superconductivity properties at certain conditions. Our results unequivocally point to a different structural order or disorder in SM/Y samples as compared to Sm based samples. We suggest that different site preferences of oxygen vacancies, predominantly created in CuO₂ planes (CuO chains) of Y and Sm-based samples, might be responsible for the observed difference in the behavior. This contention is supported by a host of other considerations and experimental observations. The study investigated the effects of Sm doping on the YBCO system on various properties such as structural, critical temperature (T_c), scanning electron microscope (SEM), irreversibility line(IL), critical current density, j_c, and flux line pinning force. It seems the sample x=0.05 undergoes an insulator transition, which suppresses its superconducting transition temperature (T_c). Additionally, magnetization was measured as a function of temperature (M-T) and magnetic loops (M-H) at constant temperatures of 10, 20, 30, 40, 50 and 60K up to 10KG.

Keywords : high-T_c superconductors, Scanning electron microscopy, X-ray scattering, Irreversibility line

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