High Field Magneto Transport Properties in $Y_{1-x}Ca_x(Ba_{1-y}Sr_y)_2Cu_3O_{7-\delta}$ SYSTEM

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It is well known that the inter-grain weak links and poor flux pinning nature reduce the superconductivity and act as limiting factors for the superconducting parameters such as critical current and critical field. However, these superconducting parameters are crucial in practical applications of these High Temperature Superconductors (*HTSc*). Therefore, controlling the inter-grain weak links and poor flux pinning nature is quite vital in enhancing the superconducting parameters. This study aims to investigate flux pinning nature and inter- granular couplings of Y_{1-x} $Ca_x(Ba_{1-y}$ $Sr_y)_2Cu_3O_{7-\delta}$ polycrystalline samples (with nominal composition of x = 0.00 - 0.25 and y = 0.00 - 0.50) and attempts to enhance the critical current density and upper critical field over the pristine sample. Polycrystalline samples of Y_{1-x} $Ca_x(Ba_{1-y}$ $Sr_y)_2Cu_3O_7$ are synthesized through conventional solid state reaction route. The phase formation is determined through *X-ray* powder diffraction, using *Rigaku X-ray* diffractometer (Cu-K_α). The *ac/dc* susceptibility (χ-*T*), Isothermal Magnetization (*M-H*) and Resistivity measurements under magnetic field ($\rho_{nor}TH$) are done by Physical Properties Measurement System (*Quantum Design*-USA PPMS-14Tesla). In both series of samples there is a remarkable increase in separation between Field Cooled (*FC*) and Zero Field Cooled (*ZFC*) along with decreasing *FC* signal. This is a clear indication of flux pining which enhance the critical current. The *ac* magnetization measurements of both Ca and Sr doped samples reveal that both doped samples possess enhanced grain couplings which may enhance the critical current. The critical current densities of two series of doped samples are calculated by means of ac susceptibility measurements and isothermal magnetization measurements. Global critical current density (J_C) of Ca doped (in smaller contents) samples and inter-grain current density (J_c^{inter}) of Sr doped samples improves three times more than the pristine sample. The estimation of temperature dependency of resistive upper critical field [$B_{C2}(T)$] is done by means of resistivity data and is also enhanced with Ca and Sr concentration. These observations are in consistent with improvements of inter-grain couplings and enhancement in flux pinning nature in doped samples over the pristine sample.

Keywords: critical current, critical field, flux pinning, inter-grain weak links, superconductivity