

Superconductivity in $\text{Bi}_{2.2}\text{Ca}_{2.8-x}\text{Sr}_x\text{Cu}_2\text{O}_y$ system and effect of rare earth substitution

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Abstract. The oxide system $\text{Bi}_{2.2}\text{Ca}_{2.8-x}\text{Sr}_x\text{Cu}_2\text{O}_y$ has been investigated for superconductivity as a function of Ca/Sr ratio with $x = 0.7, 1.0, 1.4$ and 1.8 . All these compositions are found to be superconducting with onset temperature in the range of 80–90 K implying a large homogeneity range between Sr and Ca for the superconductivity to occur in this system. Effect of partial replacement of Bi by rare earths has been studied and it is observed that 20% replacement of Bi by Nd and Eu does not significantly affect the superconducting transition temperature.

Keywords. High T_c superconductivity; oxide superconductors; rare earths.

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Over the last few months, a great deal of excitement and interest has been generated worldwide in the oxide superconductors following the observation of superconductivity with superconducting transition temperature (T_c) in the 30–40 K range in La-Ba-Cu-O system (Bednorz and Muller 1986). Soon after, superconductivity with T_c in the 90 K range was observed in Y-Ba-Cu-O system (Wu *et al* 1987). The superconducting phase in the 90 K system was found to have the stoichiometry $\text{YBa}_2\text{Cu}_3\text{O}_{7-y}$ (see, for instance, Rao *et al* 1987). Subsequently, a family of compounds with the general formula $\text{REBa}_2\text{Cu}_3\text{O}_{7-y}$ (RE = Y and trivalent rare earth) was found to exhibit superconductivity in the 90 K range (see, for instance, Murphy *et al* 1987; Hor *et al* 1987; Dunlap *et al* 1987). Superconductivity with T_c above 20 K in a system without rare earth, Y or La was observed in Bi-Sr-Cu-O system (Michel *et al* 1987). With suitable substitutions, the T_c in Bi-Sr-Ca-Cu-O and Bi-Sr-Ca-Al-Cu-O systems has been raised to 90 K with a possibility of superconductivity up to 120 K (Maeda *et al* 1988; Chu *et al* 1988; Meng *et al* 1988). Some of these results have been confirmed by us earlier (Tomy *et al* 1988).

Several groups have reported the identification of the superconducting phase in the Bi-Sr-Ca-Cu-O system (Hazen *et al* 1988; Shaw *et al* 1988; Zhang *et al* 1988; Muromachi *et al* 1988). The approximate composition of the single phase is suggested

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