The Magneto-Resistivity Anisotropy in High Temperature Superconductors Bi_{2212} & Y_{123}

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The Characteristic shape of resistivity transitions in HTS under magnetic field interaction is mysterious. The magnetoconductivity tensors σ_{xx} & σ_{xy} in case of Y123 has been computed under radiofrequency excitations 1-6 MHz range at H=8000G [1]. The Bi_{2212} characteristics curves Hall potential V_H, Hall coefficient R_H and magnetodynamically stimulated density of electrical carriers N_H along with the temporal development of magnetopotential records had been observed to relate the magnetoresistivity [2,3]. The normal resistivity and conductivity of HTS Bi_{2212} between superconducting transition temperature below 100K to above 300K had been depicted. The localized density of states is observed to create anisopropy and the oscillatory behaviour of all these parameters even at room temperatures [4,5].

Keywords: Magnetoconductivity tensors, Hall geometry, Electrical carrier density.

1. INTRODUCTION

The HTS had very low conductivity at room temperatures although they are superconductors at moderately high temperatures Bi_{2212} ~85K, Y_{123} ~90K with respect to normal superconductors having superconducting states near absolute zero. In order to regulate the conductivity in HTS even at room temperatures, one has to allow a series of interactions switching the conductivity processes in HTS. In the present attempt MRF excitations had been employed to impart electrical conductivity in HTS and the computation of magnetoconductivity reveals the magneto-resistivity anisotropy in these materials. The Hall coefficient over a range of temperatures and magnetic field below transition temperature τ reverses their signs [6,7].

2. SYNTHESIS AND PREPARATION

The studies of doping vanadium with $(Bi, Pb)_2\ Sr_2Ca_2\ (Cu_{1-x},V_x)O_y$ at low concentration of x=0.01-0.03, some enhancement effect in stabilizing the high Tc-phase of superconductivity had been observed. Such High Temperature Superconductivity (HTS) study samples were prepared by conventional solid state reaction method. The Finally ground product then compressed ~2tons/cm^2 to form cylindrical pellets of dimensions - 1.185cm & thickness - 1.2mm. These pellets were shaped into rectangular bars by further cutting and endowing with the electrods in 4-prob Hall geometry (b=0.2 cm, d=0.2cm, r=0.3mm). The role of presence of two additives in Bi-Sr-Ca-Cu-O systems represent an important participation in high Tc oxide superconductor families. At least in three phases with atomic numbers in the ratio in the order Bi, Sr, Ca, Cu namely (2201), (2212) and (2223) their superconductivity transition temperatures were found to be 15K, 85K nad 110K respectively.

3. EXPERIMENTAL STUDY

The samples were taken in 4 or 6 probe Hall geometry attended to constant current source J_x and placed in high magnetic field Hz ~Kilo Gauss range. The radio-frequency generator on Y terminals along with the Hall potential measuring digital millivoltmeter. The magneto potential data yields R_H-factors, N_H, σ_{xx} & σ_{xy} etc. The low temperature facility of NPL Laboratory had been employed to measure the conductivity and resistivity. The graphical presentation various physical parameters are shown in Figure 1 - resistance, Figure 2 - conductivity at low T, Figure 3 - magneto potential, Figure 4 - Hall coefficients, Figure 5 - N_H observations of Bi_{2212} MRF rpтanges H=7-10KG and frequency 1-6 MHz.

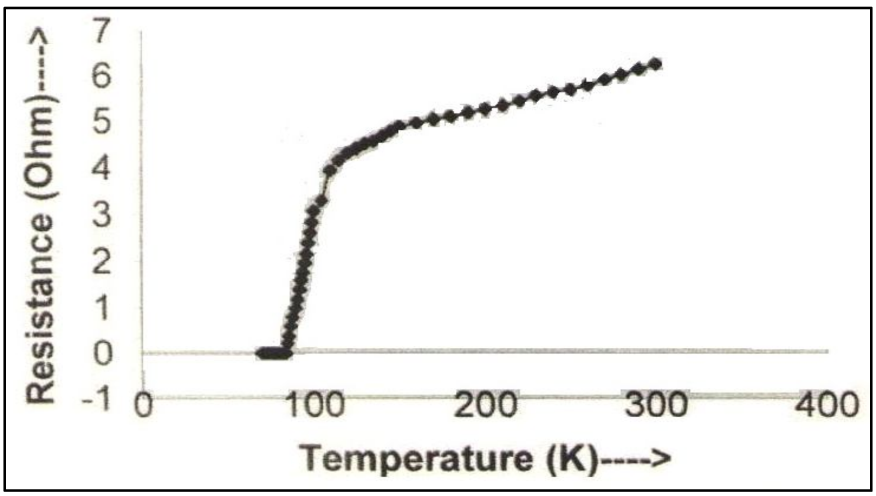

Fig. 1: Resistance as a function of Temperature for pure Bi : 2212 HTS.

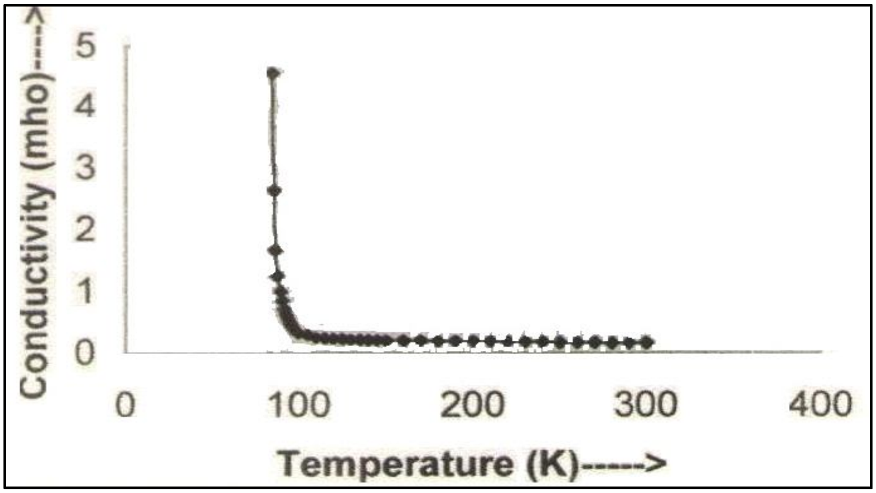

Fig. 2: Conductivity as a function of Temperature for pure Bi : 2212 HTS.

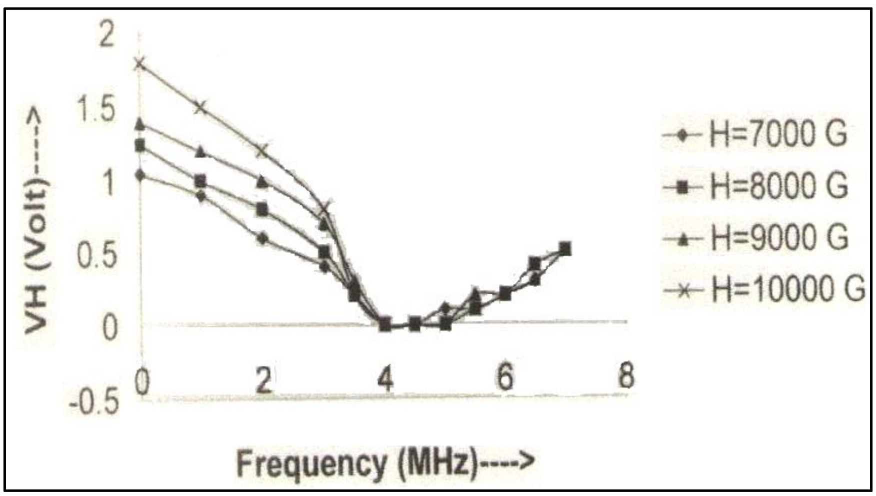

Fig. 3: Hall voltage as a function of Frequency as different magnetic fields for pure Bi : 2212 HTS.

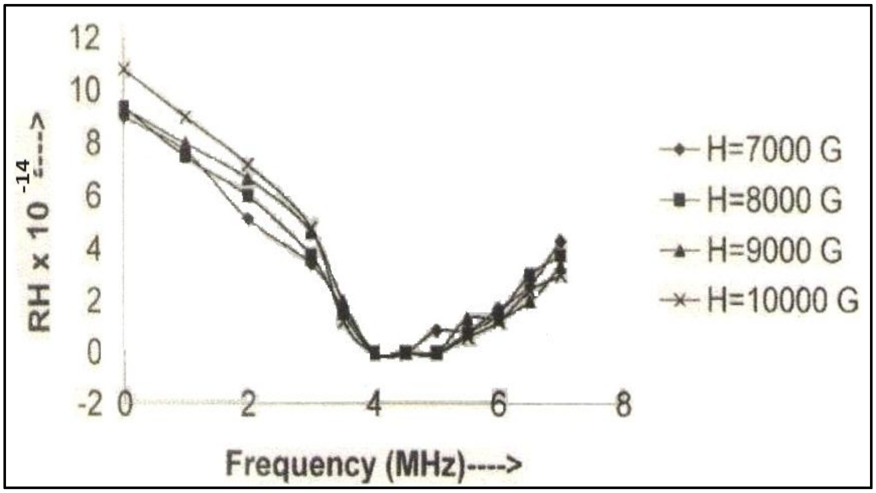

Fig. 4: Hall coefficient as a function of Frequency as different magnetic fields for pure Bi : 2212 HTS.

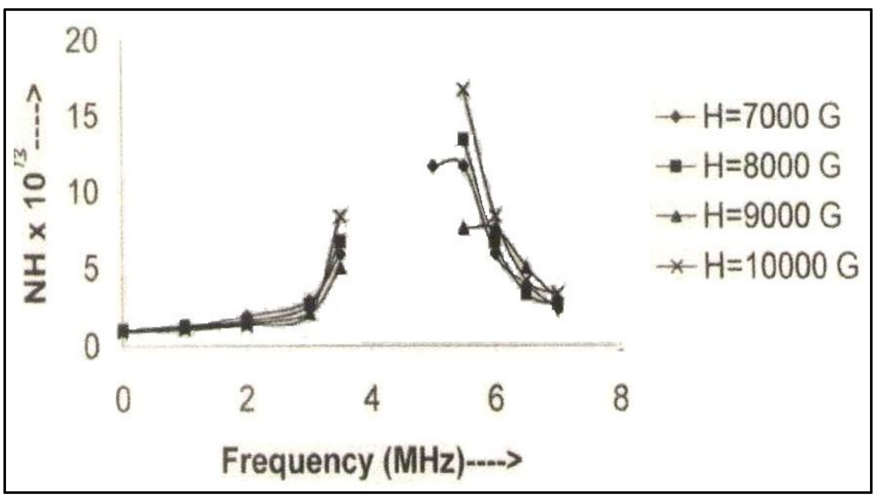

Fig. 5: MRF stimulated carriers (N_H) as a function of Frequency as different magnetic fields for pure Bi : 2212 HTS.

4. RESULTS, DISCUSSION & CONCLUSION

The striking scaling behaviour of type $\rho_{xy} \sim \rho_{xx}^{\beta}$ for longitudinal σ_{xx} and Hall resistivities respectively and β =1.7 in case of Y Ba_2 Cu_30_7 (YBCO) in T-ranges close to onset of Hall signal also seems observable in Bi2212. The experimental results of Samoilov on $Bi_2Sr_2CaCu_2O_x$ in the temperature and the field range where the mixed state has a quasi-2D character and not like to form a vortex- glass state which is quite incongruous to YBCO films where ρ_{xx} , ρ_{xy} behaviour has been argued to be a consequence vortex-glass transition vortex-system with a weak random disorder. In the present manuscript the magneto-RF Conductivity tensors for Bi_{2212} and Y123 had been presented along with radio frequency dependent Hall potentials, Hall coefficients, differential MRF conductivity and temperature dependent resistivties and conductivities etc. along with density of Hall carriers 10^{13}. The trend of experimental observations clearly reveals the anisotropic behaviour and oscillatory character of all these parameters switching the low temperature behaviour of HTS even at room temperatures.

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