Journal of Bangladesh Academy of Sciences, Vol. 35, No. 2, 161-169, 2011

TRANSPORT AND MAGNETIC PROPERTIES OF $(Fe_{100-x}V_x)_{75}$ $P_{15}C_{10}$ AMORPHOUS ALLOYS

M.A.S. KARAL*, M. KAMRUZZAMAN AND F.A. KHAN

Department of Physics, Bangladesh University of Engineering and Technology (BUET), Dhaka-1000, Bangladesh

ABSTRACT

$(Fe_{100-x}V_x)_{75}P_{15}C_{10}$ (x = 0, 5, 10 and 15) amorphous alloys in the form of ribbon were prepared by the standard melt spinning technique and studied their transport and magnetic properties. The resistivity follows 'Mooij correlation' at low temperature (300 - 93) K. The Hall resistivity and the magnetoresistance (MR) were measured in an applied magnetic field up to 0.6T at room temperature (RT = 300 K). Anomalous Hall effect was observed in the Hall resistivity measurement and MR was found to vary 0 - 8%. The saturation magnetization gradually decreased with the increase of V in the alloys at RT.

Key words: Resistivity, Mooij correlation, Hall resistivity, Magnetoresistance, Saturation magnetization

INTRODUCTION

Fe-based glassy alloys have been used in many electrical devices such as magnetic wires, sensors, band-pass filters, magnetic shielding and energy-saving electric power transformers (Szewieczek *et al.* 2007, Inoue *et al*. 2000, Schwarz *et al.* 2004) due to their satisfactory soft magnetic properties. Isotropic and anisotropic spin scattering mechanism should contribute to the resistivity and anomalous Hall effect in magnetically ordered amorphous metals (Heinemann *et al.* 1987, Cote *et al.* 1981, Sinha 1971, Kaul *et al.* 1986). For the scattering centers magnons, magnetic impurities and topological spin disorder had been proposed (Kaul *et al.* 1986, Kaul 1979).

In many cases, the structural disorder of the atomic sites was projected into the spin lattic (Cote *et al.* 1981, Erle *et al.* 1988) thus introducing a magnetic scattering contribution to the resistivity aside from thermal excitations. However, this contribution was found to be small in most cases (Jen *et al.* 1988); apparently, anisotropic scattering was a much more sensitive tool to identify spin scattering contributions in amorphous metals. Mooij (Mooij 1973) pointed out a correlation of the electrical resistivity (ρ) and its temperature coefficient of resistivity (TCR = $1/\rho \times d\rho/dT$) at low temperature in metallic alloys. Mooij (Mooij 1973) observed that TCR changes sign in a relatively narrow range of resistivity (i.e., the critical resistivity for which TCR = 0, $\rho_c \approx 100$ - 160 $\mu\Omega$-cm).

* Corresponding author: <asayem221@phy.buet.ac.bd>.