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CHARACTERIZATION OF AMORPHOUS $Fe_{69}V_6P_{15}C_{10}$ METALLIC ALLOY

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ABSTRACT

$Fe_{69}V_6P_{15}C_{10}$ amorphous metallic alloy was prepared by the standard melt spinning technique and characterize their structural, transport, thermal and magnetic properties. The composition of the as prepared alloy was confirmed by energy dispersive X-ray (EDX) and the surface morphology was carried out by scanning electron microscopy (SEM). The structure of the as prepared and annealed sample was studied by X-ray diffraction (XRD). The XRD patterns of annealed sample shows that contain a BCC structure for temperatures between 400°C and 450°C and a hexagonal structure for temperatures between 500°C and 650°C. The grain size of the sample is found to vary from 20 to 53 nm. Hall resistivity and magnetoresistance (MR) was measured using four-probe technique. Resistivity remains constant upto 400°C and then decreases with the increase of temperature. The crystallization behavior of the sample was performed by differential thermal analysis (DTA). Magnetization was measured by using vibrating sample magnetometer (VSM) at room temperature and the measured value of the saturation magnetization was 82.6 emu/g. Both the magnitude of impedance and phase angle remained constant upto 10 MHz and then remarkably increased with frequency.

Keywords: EDX, XRD, Hall resistivity, MR%, DTA, Magnetization, Impedance.

1. INTRODUCTION

Amorphous ferromagnetic alloys are interesting from both the fundamental and applied viewpoints. Fe-based glassy alloys are used in many electrical devices such as magnetic wires, sensors, band-pass filters, magnetic shielding and energy-saving electric power transformers [1, 2] due to their satisfactory soft magnetic properties. Many studies [3-6] have been made of Fe-based amorphous and crystalline alloys in order to understand them. Metallic glasses, which are in a metastable state, can crystallize when heated or held at elevated temperatures for a sufficient time. Crystallization involves a change in properties, such as heat capacity, electrical resistivity and magnetization properties [7]. DTA technique is the most frequently used method to study the crystallization behavior. The crystallization behavior of metallic glasses has been extensively studied [8-13]. The physics of metallic glasses is the field of great experimental and theoretical interest for anomalous behavior of resistivity and Hall Effect since they involve quantum interaction of short-range ordered structural units as well as meta-stable structural transitions with temperature. Isotropic and anisotropic spin scattering mechanism should contribute to the resistivity and anomalous Hall effect [14] in magnetically ordered amorphous metals. For the scattering centers spin-flip and magnons, magnetic impurities and topological spin disorder (frustrated spins, etc.) has been proposed [15, 16]. In many cases, the structural disorder of the atomic sites is projected onto the spin lattice [15, 17] thus introducing a magnetic scattering

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