

STRUCTURAL AND MAGNETIC PROPERTIES OF THIN FILMS BASED ON $\text{Fe}_{40}\text{Ni}_{38}\text{B}_{18}\text{Mo}_4$ ALLOYS

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Abstract

$\text{Fe}_{40}\text{Ni}_{38}\text{B}_{18}\text{Mo}_4$ alloys exhibit excellent soft magnetic properties. It is known that the origin of magnetisation in amorphous alloys such as $\text{Fe}_{40}\text{Ni}_{38}\text{B}_{18}\text{Mo}_4$ is the result of interaction due to the nanocrystalline α -iron dispersed in a residual amorphous matrix. So studies on the crystallization of these alloys assumes importance. Thin films based on $\text{Fe}_{40}\text{Ni}_{38}\text{B}_{18}\text{Mo}_4$ alloys are important from the application point of view, as they can be potential materials for magneto optical applications.

Melt spun alloys having the composition $\text{Fe}_{40}\text{Ni}_{38}\text{B}_{18}\text{Mo}_4$ have been subjected to crystallization studies and thermal studies using X-Ray diffraction and Differential scanning calorimetry. Thin films based on these $\text{Fe}_{40}\text{Ni}_{38}\text{B}_{18}\text{Mo}_4$ alloys have been prepared by vacuum evaporation and were subjected to annealing. Magnetisation studies performed on $\text{Fe}_{40}\text{Ni}_{38}\text{B}_{18}\text{Mo}_4$ ribbons and thin films annealed at different temperatures reveal interesting properties. As-spun ribbons show excellent near square loop characteristics with a saturation magnetisation of 100 emu/g and a coercivity of 40 Oe. Annealed thin films samples are reflecting and samples annealed at 100⁰C show excellent magnetic properties. Samples annealed at 400⁰C lose their magnetic properties completely and become diamagnetic. The coercivity of thin film samples is higher than that of the pristine melt-spun ribbon. Annealing also decreases coercivity. The change in coercivity can be attributed to the increase in grain size. XRD studies indicate that melt-spun ribbons are less crystalline and crystallinity is enhanced with firing. Upon annealing, the thin films exhibit improved crystallinity as evidenced by XRD. The details are presented in this paper.