**A STUDY OF FERROMAGNETIC SHAPE MEMORY ALLOYS OF Ni-Mn-Ga SYSTEM**

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**ABSTRACT**

Two different alloys of Ni-Mn-Ga system Ni50.7Mn27.7Ga21.6 (rich in Ni - sample A) and another Ni46Mn35Ga19 (poor in Ni- sample B) have been prepared by induction melting followed by quenching in water. The ingots were homogenized at 830 oC for 7 days. Their compositions are determined from EDAX. Structural and magnetic properties of these alloys are studied in this work. From low field ac susceptibility measurements, the martensitic transformation temperature TM and Curie temperature TC are determined for samples A and B. TM is determined to be 306 K and TC to be 373 K for sample A. For sample B TC is found to be 358 K, but structural transformation was not observable while heating. However indications of a second transformation just above TC was observed while cooling. To resolve this problem, DSC measurements have been carried out in the sample B, which showed TM to be 383 K, which is well above the Curie temperature of the sample. The values of TM andTC of sample A and TC of sample B determined from DSC agree well with those from ac susceptibility measurements. From these results we see that both the samples are in martensitic phase at room temperature (RT). In both the techniques, thermal hysteresis between heating and cooling cycles is observed at TM indicating the martensitic transformation to be of first order. It is due to thermal hysteresis that the structural transformation was not observed while heating sample B, but was seen while cooling. Absence of thermal hysteresis at TC supports the fact that ferro-para transition is of second order. X-ray diffraction studies have been carried out at RT and the crystal structure of the samples A and B have been determined. The XRD patterns are indexed, comparing them with similar patterns available on nearby compositions in literature. From the analysis of the patterns, structure of sample A is determined to be *orthorhombic* with *7M* modulation along b-axis. The structure of sample B is determined to be *non-modulated (NM) tetragonal* at RT. Sample B, which has TM greater than TC undergoes martensitic transformation in *paramagnetic state* and hence cannot be used for FSM application at RT, but can be used for Thermal shape memory applications where temperature is the driving force instead of magnetic field.

*Keywords: Martensitic transformation temperature (TM); Curie temperature (TC); Ferro-para transition.*