PREFACE

Metallic glasses are the materials of high practical and scientific interest. They are found to possess superior magnetic properties compared to their crystalline counter-part. The superiority is considered to be associated with better compositional homogeniety and absence of atomic periodicity. Due to the disorder, there is a distribution of exchange interaction of these alloys. In some circumstances, the exchange interaction can even change sign. For example, in a ferromagnetic host their can be antiferromagnetic interaction. As a result some alloys having competing ferromagnetic and antiferromagnetic interaction exhibit 're-entrant' magnetic behaviour. This behaviour has been studied here theoretically.

The macroscopic behaviour of a ferromagnetic material is determined by anisotropy. In crystalline alloy magneto-crystalline anisotropy is the main source of anisotropy. The structure of amorphous alloy does not possess atomic periodicity. So magneto-crystalline anisotropy is absent for this type of material. But during fabrication process of amorphous alloy, the microstructural defects are frozen-in, orginating internal stress field and giving rise to magneto-elastic anisotropy which is normally small. Thus macroscopic moment can be induced with the small field resulting large initial permeability and small coercive field. Due to the presence of internal stress the macroscopic property will be a sensitive function of thermal history and external stress. As it is very difficult to study the macroscopic magnetic property theoretically, this property has been studied experimentally. The experiments are carried on two amorphous alloys - $Fe_{81}B_{13.5}Si_{3.5}C_2$ and $Fe_{40}Ni_{40}B_{20}$ which are in ribbon form having thickness of the order of 30 μm . $Fe_{81}B_{13.5}Si_{3.5}C_2$ (Metglas 2605 SC) sample is supplied by Allied Chemical Corporation, U.S.A. and is aged for three years. $Fe_{40}Ni_{40}B_{20}$ alloy is donated by Dr. K. Westerholt of Bochum University, FRG.

Thermal variation of spontaneous magnetization, $M_s(T)$ at low temperature gives the information about the excitation of the magnetic system. In the localised magnetic system the excitation are spin wave which give rise to $T^{3/2}$ dependence of $M_s(T)$. In itinerant system magnetization decreases as T^2 . So, in order to ascertain the nature of excitation we have studied the thermal behaviour of magnetization (M) of $Fe_{40}Ni_{40}B_{20}$. It is found that magnetization follows $T^{3/2}$ behaviour which states the existence of spin wave like behaviour.

Since the metallic glasses are excellent soft magnetic materials, it can be used in power and electronic devices. A model sensor has been developed which is suitable to detect a displacement of the order of few micrometer.

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