## 1.1.15. GIANT MAGNETO-IMPEDANCE BEHAVIOUR OF A NANOSTRUCTURED MATERIAL FOR APPLICATION IN NDE BASED SENSING DEVICE

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Non-Destructive evaluation (NDE) is a potential area for health monitoring of components. Ferromagnetic alloys as components materials can be evaluated non-destructively with appropriate NDE devices bearing sensitive core elements with Giant magneto-impedance (GMI) properties. The GMI behaviour consists in drastic changes of the ac impedance of soft magnetic materials upon the application of an external magnetic field. The GMI effect was found to be dependent on the composition of the material, frequency of the applied current and amplitude of the driving field, among other factors, which spawn a number of interesting new magnetic phenomena. In the present work the GMI properties of materials having composition $(Co_{94}Fe_6)_{72.5}Si_{12.5}B_{15}$ (in at%) has been studied to optimize the driving field and frequency. The material was prepared at the laboratory by rapid solidification (in-water quenching) technique. The material was Joule heated with different current density and period to enhance the GMI property upto 300%. The $(Co_{94}Fe_6)_{72.5}Si_{12.5}B_{15}$ sample with optimized parameters was used to develop a magnetic sensing device for NDE application. The device has great potential to monitor the microstructural changes that takes place in steel during in-service operation. In the recent work experiment has been carried out with various test samples simulated at the laboratory condition. Experiment has been carried out with the 9Cr-1Mo sample subject to various creep exposures. A good correlation was found for the creep data obtained through usual magnetic technique and that obtained through developed GMI sensing device. Experiment was also extended for the plastically deformed 304SS. In this case sensor output voltage increased with % of deformation of the steel. The formation of martensite during deformation is the cause of such changes.