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Anhysteretic magnetization and magnetostriction of thin NiFe films under stress and plastic deformation PETER FINKEL, ED GARRITY, Thomson, SAM LOFLAND, Rowan University — The magnetic properties of thin samples of a thin film NiFe sample under tensile stress are investigated. The magnetostriction contribution to dc magnetization under elastic stress and the effect of the plastic strain on the hysteresis loops are discussed. Also, a role of the plastic deformation interrelated with the elastic stress in the magnetization process is established. An experimental system based on a conventional vibrating sample magnetometer equipped with the specially designed loading fixture and optical resonant spectroscopy tension monitoring technique is used to measure anhysteretic permeability and magnetization curve as a function of stress and temperature. This method used to measure anhysteretic permeability and magnetization curve of Ni-Fe as a function of stress and temperature. Anhysteretic permeability was extracted from the anhysteretic $B - H$ curves constructed by degaussing the sample at given longitudinal (parallel to the stresses) dc field. The large positive magnetostriction constant of FeNi samples leads to higher susceptibility and lower coercivity with tensile stress while the large volume magnetostriction results in reduced saturation magnetization. Large stresses imposed on the sample result in plastic strain of the sample which induces increase in dislocation density and domain wall pinning. This causes the gain in hysteresis loss and coercivity to increase at the highest stresses. We also discuss the effect of the Ni composition on results of the measurements.

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