MAGNETIC BEHAVIOR OF ARRAYS OF NICKEL NANOWIRES

S. Karim, K. Maaz, M. Ahmed and A. Nisar
Physics Division, Directorate of Science, PINSTECH, Nilore, Islamabad

Recently, there is an increasing interest in magnetic nanowires because of their unusual properties compared to the bulk materials [1]. To understand the complexity of nanowire arrays and to improve their potential in various applications more studies are still needed, for example, to understand completely the effect of geometrical factors, i.e. aspect ratio, areal density etc., on magnetic properties of these arrays.

In this work, arrays of nickel nanowires with aspect ratio ~1200 and diameter ranging between 25-100 nm were fabricated by electrodeposition in etched ion track templates. Samples with areal density from 1×10^{6} cm^{-2} to 1×10^{8} cm^{-2} were prepared. Measurements of magnetic hysteresis loops were performed at room temperature with SQUID magnetometer and magnetic properties of arrays of different diameters and aspect ratios were compared. Coercivity of the wires showed strong dependence on aspect ratio, diameter and microstructure. Room temperature coercivity of the wires (Fig.1) showed a maximum at ~ 40 nm diameter and arrays with high density of nanowires showed lower coercivity. The results were discussed by taking into account anisotropies originating from the shape, crystalline structure and magnetostatic interactions among the wires and by previous experimental observations in literature [2, 3].

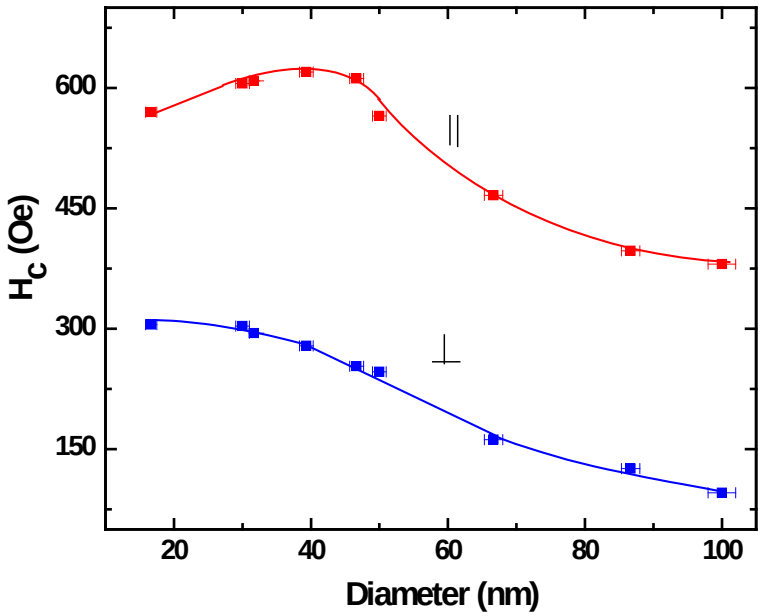

Fig. 1 Coercivity, H_c (Oe), as a function of diameter inder the field applied parallel and perpendicular to the wire long axis

References

1. D. H. Reich, M. Tanase, A. Hultgren, and G. J. Meyer, J. Appl. Phys. **93** (2003) 7275.
2. K. M. Razeeb, F. M. F. Rhen and S. Roy, J. Appl. Phys. **105** (2009) 083922
3. E. Ferain and R. Legras, Nucl. Instrum. Methods Phys. Res. B **174** (2001) 116.