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FABRICATION OF MAGNETIC NANOWIRES BY TEMPLATE ASSISTED PULSED ELECTRO-DEPOSITION TECHNIQUE

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ABSTRACT

Magnetic nanowires have tremendous potential in future nanotechnology like magnetic storage and high frequency magnetic logic devices. Not only that they are the basic building blocks of future magnetic data storage such as patterned and perpendicular magnetic media but also magnetic domain movement or spin waves may be used as an information carrier. The important aspects of nanomagnets are the fabrication of ordered arrays in a cost effective manner and to probe their static and dynamic magnetic properties by highly sensitive nond estructive techniques. Electrochemical filling of track etched polycarbonate templates provides a simple inexpensive way to produce magnetic nanowire arrays.

Here, we report the synthesis of ordered array of Co and permalloy ($Ni_{80}Fe_{20}$) nanowires using a pulsed electrochemical deposition method through porous track etched polycarbonate templates. Permalloy is a ferromagnetic alloy that exhibits unique magnetic properties such as high permeability, small coercivity, negligible magnetostriction, and distinct anisotropic magnetoresistance. Structural and compositional studies of nanowires have been carried out by SEM, TEM, AFM, XRD and EDAX to establish the structural and material purity. The vibrating sample magnetometer technique was used to measure the magnetic hysteresis loops for the nanowires embedded in the template. The loops measured with external magnetic field applied parallel and perpendicular to the axis of the nanowires showed a clear difference in the shape and the coercive field, indicating the effect of shape anisotropy.