Magnetic Force Microscopy Study of Magnetic Nanowires and Structures

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The study of magnetic nanostructures is of great interest due to their potential applications in ultrahigh density storage and logic function [1] Anodization processes to achieve self-ordered nanopores in membrane have been proven to be a direct, simple, nonexpensive technique to fabricate templates for highly ordered densely packed arrays of magnetic nanowires.[2] Magnetic force microscopy (MFM) imaging is a very powerful technique to locally study the magnetic state of nanostructures. In this work, we have used the MFM to characterize the magnetization of chemically synthesized nickel nanowire of diameter between 100nm and 200nm, which allow imaging with the spatial resolution of 10-100nm.[3].

In MFM, the magnetic contrast is obtained through detecting the force gradient between a ferromagnetic tip and the magnetic sample by amplitude, phase or frequency detection techniques. In this work we have used LiftMode [4] with phase detection technique to obtain magnetic imaging at different tip height ranging from 25nm to 100nm [Fig 1]. We have found that magnetic contrast of these nanowires changes with tip height. Phase shift vs different tip height graphs for different distances in the nanowire are also obtained [Fig 2]. An emphasis is on obtaining quantitative information from these measurements. A micromagnetic simulation is also presented based on a computer code OOMMF [5]

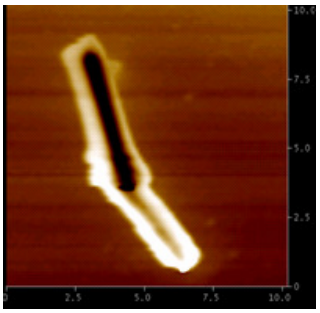

Fig 1: MFM image of Ni nanowire at 45 nm tip height

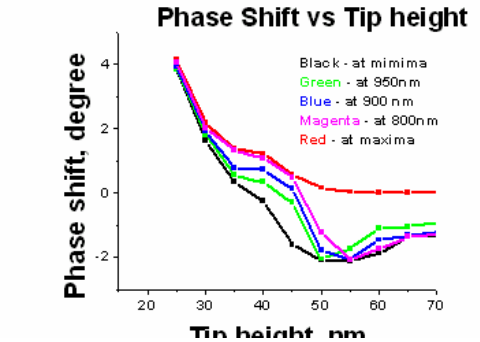

Fig 2: Phase shift at different tip height for different distance in nanowire

height for dif

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