Block Copolymer Nanolithography for the Preparation of Patterned Perpendicular Magnetic Recording Media
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Abstract:
Many Block copolymers Self-assemble into a range of different nanostructure and the size of the nanostructures depends on the properties of polymer such as molecular weight, its distribution and fraction of blocks present in the polymer. This property enables some block co-polymers to be used as templates for the formation of Nanowires. Laterally ordered diblock copolymer thin films of Polystyrene (PS) and Polymethylmethacrylate (PMMA) with domains oriented normal to the surface can be obtained on substrates with balanced interactions. Block copolymers of Styrene and MMA with styrene fraction of ~0.7 give cylinders of PMMA incorporated into a continuous phase of PS. For molecular Weights of ca. 36,000 this gives PMMA cylinders of approximately 12-40 nm wide.

The block copolymer is spin coated on Si substrates and then it is annealed at 170°C for 24 hr. The thickness of the film, determined by Dektak Profilometer, was found to be 100 nm. Topography of the films was determined by Tapping Mode AFM.

Two blocks of the polymer self-assemble in two phases when the polymer is heated above its glass transition temperature for a significant amount of time. The size of the PMMA columns obtained for this polymer varies between 20-40 nm. The PMMA phase can be degraded by UV curing (253.7 nm) and then rinsed with acetic acid. The time of curing should not be more than 4-5 hr, otherwise PS also could get degraded. Magnetic materials like Co/Pt can be deposited in the pores by electrodeposition.

Future Work:
Electrochemical Impedance Spectroscopy (EIS) will be used to check whether the pores obtained in the films are through the polymer layer or not. Electrodeposition will be used to deposit Co/Pt in the pores. EDAX and XPS will be used to confirm the presence of Co/Pt. Study of effect of different metal underlayers, like Cu, Ni, Au on orientation of polymer is also planned.

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