Title:	DEVELOPMENT OF LOW DIMENSIONAL COBALT-IRON BASED HEUSLER ALLOY SYSTEMS FOR MAGNETIC AND MAGNETO-OPTICAL APPLICATIONS
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Abstract:	Heusler alloy (HA) materials are an extremely important class of magnetic material that are expected to have a wide range of spintronics or spin based electronics applications such as, in magnetic recording medium, in thermoelectricity, magneto-optical device applications, shape memory alloy etc. In this thesis, we have worked towards development of Co 2 Fe-based HAs thin films and nanocrystals using novel growth schemes. Co 2 Fe-based HAs are an exciting Heusler class of materials having high magnetic ordering temperature, with capability to support large spin polarization current and are also predicted to exhibit interesting topological properties. This thesis presents new approaches towards alternative methods beyond conventional techniques to grow HA nanostructures. The thesis further presents evaluation and understanding of the magnetic properties of these HA nanostructures for magneto-optical and magneto thermal applications. The deposited films show a large degree of magneto-optical Kerr rotation as well as high saturation magnetization at room temperature. The Kerr measurements show rotation reaching up to a maximum value of ≈ 0.3° on polycrystalline copper substrate and ≈ 0.8° on a single crystalline platinum substrate which is comparable with the films grown by conventional techniques. Using Kerr microscopy studies we understand the formation and evolution of the magnetic domains in these electrodeposited films. Through these studies we develop an understanding of surface magnetization reversal in the electrodeposited films. The static MOKE measurements also reveal that electrodeposited samples possess strong uniaxial magneto-crystalline anisotropy which is very important for device applications. Furthermore, angle dependent MOKE measurements reveal a two-fold symmetry in the electrodeposited Co 2 FeSn films that can be expected in highly ordered crystalline Heusler alloy phase. We also synthesized highly B2 ordered Co 2 FeSn and L2 1 ordered Co 2 FeAl HA nanocrystals. These studies show the possibility of growing highly crystalline and well-ordered Heusler nanoparticles. The structural optimization is found to lead to improved magnetic properties for both cases. Magneto thermal measurements under oscillating magnetic field show that these Heusler nanoparticles are capable of generating heat that can be useful for hyperthermia studies.
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