1:00 PM
Pulsed Laser Deposition of Chromium-Doped Zinc Selenide Thin Films and Nanostructures for Mid-Infrared Laser Applications: Jonathan Williams[1]; *Renato Camata*[1]; [1]University of Alabama at Birmingham

Intra-shell transitions in divalent metal ions such as Cr2+, Fe2+, and Ni2+ (transition metals) incorporated in the lattice of wide band-gap II-VI semiconductors offer excellent prospects for affordable laser sources in the 3-5µm spectral range, a wavelength regime in high demand for numerous applications. In this study we have targeted the creation of Cr-doped ZnSe thin films and nanodots by pulsed laser deposition (PLD). Films and nanodots with nominal Cr concentration in the 1019-1020/cm3 were deposited at various temperatures on GaAs (450-550°) and sapphire (600-700°) substrates through KrF excimer ablation of hot-pressed targets containing appropriate stoichiometric mixtures of Zn, Se, and Cr species in a helium background environment (10-4 Torr). Deposited films and dots were analyzed using X-ray diffraction to determine quality of crystalline structure and energy dispersive X-rays to assess the actual Cr concentration incorporated into the films. Photoluminescence measurements were carried out to evaluate emission in mid-infrared.

2007 Nanomaterials: Fabrication, Properties and Applications: Session IV

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Tuesday PM Room: Oceanic 3
February 27, 2007 Location: Dolphin Hotel

Session Chairs: Stephen Pearton, University of Florida; Seung Kang, Qualcomm Inc.

2:00 PM Invited
Magnetism and Transport in Epitaxially Grown Fractals and Nanodots of Transition Metal Alloys and Compounds: *R. Budhani*[1]; [1]Condensed Matter – Low Dimensional Systems Laboratory, Indian Institute of Technology Kanpur

Magnetic materials in zero, one and two dimensional geometries such as clusters consisting of a few thousand atoms, wires with nanometer scale diameter and ultra thin films respectively, have been at the centre stage of condensed matter/materials physics, and are the basis of a myriad of technologies. The fundamental interest in low dimensional magnetic materials emanates from the fact that a macroscopic property such as magnetization, which is a consequence of the cooperative response of millions of spins, can be altered in a non-trivial manner if a large fraction of these spins are made to reside on the surfaces or interfaces of a magnetic entity. The dynamics of electron spin in low dimensional systems gives rise of a variety fascinating effects which can be the basis for a large number of technologies. One of the promising ways to synthesize low dimensional structures such as self-organized nanodots and self-similar fractals is through stress engineered epitaxial growth. We have successfully used pulsed laser ablation technique to grow low dimensional structures of high coercivity alloys such as CoPt and oxides of the La1-xSrxMnO3 family on single crystal substrates which provide either tensile or compressive strain. A suitable choice of growth temperature, vapor flux and lattice mismatch optimizes the balance of the surface, interface and elastic energies of the growing film and leads to the formation of self-organized and self-similar structures. This talk will focus on the dynamics of magnetic relaxation and spin-dependent electron transport in such structures.

2:25 PM Invited
Functional Magnetic Nanostructures: *Srikanth Hariharan*[1]; [1]University of South Florida

Magnetic nanostructures are considered as basic building blocks in spin-electronic devices and high-density data storage. In practical applications, functional nanostructures generally consist of particle aggregates that are assembled or embedded in non-magnetic media. Precise mapping of fundamental parameters like the magnetic anisotropy and switching fields over a wide range in temperature and magnetic fields, is essential to understand the influence of relaxation, interactions, surface structure and other phenomena that govern the dynamic magnetic properties in these systems. RF transverse susceptibility experiments, developed by us, provide a very sensitive and unique way to probe these features. This talk will feature our studies of the spin dynamics in functional magnetic nanostructures ranging from ordered arrays, polymer nanocomposites to ferrofluids. The potential broader applications of magnetic nanoparticles in RF devices, magnetic refrigeration and novel energy conversion will be discussed. Research supported by grants from NSF and DARPA/ARO.

2:50 PM
Domain Structures and Induced Magnetic Properties of Isolated and Interacting Iron (Fe) Ellipsoids inside Carbon Nanotubes: *Prabeer Barpanda*[1]; [1]Rutgers University

Carbon nanotubes have attracted significant attention owing to its unique combination of mechanical strength and tunable electronic properties. Often, the single wall nanotubes (SWNT) are produced by catalysis taking iron as a precursor. This process results in introduction of residual iron nanoparticles inside the grown SWNT. The existence of these ferromagnetic iron nanoparticles can be used to introduce magnetic properties to SWNT, which can be used in various applications. In the current study, the domain structure of 20-200 nm long ellipsoidal iron nanoparticles has been investigated as a function of its size, ellipsity and aspect ratio, using a 3-D FFT modeling technique. The small size and high shape anisotropy forces a single domain structure. The coercivity of iron ellipsoids upon application of external magnetic field has been correlated to the possible interaction with covering nanotubes. Eventually, the magnetic interaction of two closely spaced ellipsoids inside SWNT has been scrutinized.

3:05 PM
Synthesis, $L1_0$ Ordering, and Magnetic Properties of $Fe_{50}Pt_{35}Rh_{15}$ Nanoparticles: *Mohammad Shamsuzzoha*[1]; Zhiyong Jia[1]; David E. Nikles[1]; J. W. Harrell[1]; [1]University of Alabama

$Fe_{50}Pt_{35}Rh_{15}$ nanoparticles in the size range of 2 to 3. 5 nm with the disordered fcc (*A*1) structure were prepared by the simultaneous reduction of platinum acetylacetonate, iron acetylacetonate and rhodium actylacetonate. Upon annealing, the nanoparticles transformed to the fct ($L1_0$) phase at temperatures that are lower than those observed in pure FePt nanoparticles. Maximum ordering was achieved at a temperature of about 500°C. As prepared nanoparticles were superparamagnetic, but progressively became ferromagnetic with heating by partially transforming into the high-anisotropy $L1_0$ structure. The coercivity reached a maximum of around 6000 Oe at an annealing temperature of about 500°C.

3:20 PM
High-Temperature Magnetic Material: Nanostructured ε-Phase Fecon: Raghumani Ningthoujam[1]; Namdeo Gajbhiye[2]; *Nori Sudhakar*[3]; A. K. Nigam[4]; [1]Chemistry Division, Bhabha Atomic Research Centre, Mumbai; [2]Chemistry Department, Indian Institute of Technology; [3]Physics Department, Indian Institute of Technoloy; [4]Tata Institute of Fundamental Research Centre

The Fe-Co-N alloy in hexagonal close packing structure (ε-phase) is a potential candidate for high-temperature magnetic materials applications such as inductive heads by virtue of their high saturation magnetization, high Curie-temperature and low coercivity. Here, the interesting structural and magnetic properties of the nanostructured ε-Fe3-xCoxN (x = 0.4) system are presented. The magnetic phase is further probed by Mössbauer study which shows a mixture of sextet and doublet patterns for Co-doped ε-Fe3N. The sextet pattern originates from the a-Fe particle coming out of nitride matrix and a hyperfine field of 40 Tesla is observed. The doublet is a characteristic of the superparamagnetic nature of Co-doped ε-Fe3N system. ZFC and FC magnetizations show a blocking temperature of 74 K for Co-doped ε-Fe3N. The magnetization and Tc in crease with Co-doping.

3:35 PM Break