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The Materials Information Society

The Macrogram

Hartford Chapter of the ASM International
Build on our Strengths - Leverage our Diversity - Network to Succeed

MONTHLY MEETING FOCUS – STUDENTS, THE FUTURE

May 8, 2007 - Student Night
Topic: UConn Research
Competition Poster Session

Speaker: UConn Students
Members of UConn Materials Advantage Student Chapter

Directions: Willington Pizza House
25 River Road, Rt 32 · Willington, CT
860-429-7433
www.willingtonpizza.com

Willington's is located on Route 32 half a mile north of the intersection of Routes 195 and 32 on the left.

From Hartford
Take exit 68 (Route 195 exit), take a right off the ramp and follow 195 towards Storrs. After 6 miles, turn left onto Route 32 at the Xtra Mart. Willington Pizza House is half a mile down on the left.

From Storrs
Route 195 towards Willington. Turn right onto Route 32. Willington Pizza House is half a mile down on the left.

Agenda:	**Program Charges:**
Cocktails: 5:45-6:45 PM	Regular Members - $20.00
Dinner: 6:45-7:30 PM	Retirees - $10.00
Program: 7:45-8:45 PM	Full Time Students - $5.00

Technical Chairperson: Rainer Hebert

Reservations: Call Shirley at Dynamic Metals (860) 583-3336 *by noon May 3rd*. Students contact Rainer Hebert (860) 486-3155. **Thanks!**

Abstract - Presentations:

The over seventy research projects of the Graduate and Undergraduate students of UConn's Materials Science and Engineering Program pass through extensive peer and faculty review with the best competing to be the three selected for presentation to the Hartford Chapter.

Materials

- Metals
- Ceramics
- Polymers
- Electronic materials
- Biomaterials
- Composite materials
- Nanoscale materials and nanotechnology

Areas of Research Concentration

- Advanced Coatings
- Alloy Design
- Ceramics
- Composites
- Corrosion
- Electronic Materials
- Materials Characterization
- Materials Simulation
- Mechanical Behavior
- Nanostructured Materials
- Physical Metallurgy
- Solidification Processing
- Solid Freeform Fabrication

2005

2006

Speaker: Bamidele Allimi

Advisor: Dr. Pamir Alpay

Bio: Dele received his Bachelors (Engineering Physics) in 2000 from The Obafemi Awolowo University, Ile-Ife, Nigeria. After working for two years with Deloitte and Touche, Nigeria, he moved to Bowling Green State University, Ohio, USA where he received his Masters degree (Physics) in 2005. He worked on the Photocurrrent measurement of Gallium Arsenide deposited on Silicon by Pulsed Laser Deposition (PLD) technique for his Masters thesis. Dele joined the Functional Materials group as a PhD candidate in fall, 2005 and currently working on PLD of metal insulator materials - V2O3 and ferromagnetic materials - CoFe2O3.

Topic: Growth of V2O3 thin-films on sapphire substrates via pulsed laser deposition.

Abstract:
This presentation is on the growth of V2O3 thin-films on sapphire substrates via pulsed laser deposition (PLD). The films were characterized using X-ray diffraction (XRD), X-ray photoemission spectroscopy (XPS), X-ray absorption fine structure (XAFS) spectroscopy, and atomic force microscopy (AFM). XPS measurements confirmed that the stoichiometry of the powder was conserved in the films. XRD patterns together with XAFS measurements proved that V2O3 was epitaxial on the a- sapphire substrate with epitaxial relation (110)film//(110)substrate and the results were consistent with the epitaxy on the c-plane substrate as well. A strain effect of substrates on the film is discussed.

Speaker: Ramesh Nath

Advisor: Dr. Bryan Huey

Bio: Ramesh graduated from the National University of Singapore (NUS) with a Bachelor of Science with Honours (Materials Science) in 2001. He then continued his Masters in Science in NUS (Materials Science) where he graduated in 2003. His masters thesis topic involves the in situ TEM observation of nickel silicide formation on SiGe substrates. After graduation, he then continued in the area of in situ TEM studying silicide and magnetic film growth as a research scientist. Ramesh joined the UConn IMS Materials Science and Engineering program in the Fall semester of 2004. He joined the NanoMeasurements Lab under the guidance of Prof. Bryan Huey, studying the imaging of ferroelectric domains using Piezo Force Microscopy (PFM). Since then, Ramesh has developed a novel method of High Speed PFM, which allows the acquisition of data a higher rate, up till to 2 orders of magnitude or more, compared to conventional PFM.

Topic: Dynamic studies of ferroelectric domain switching using high speed piezoresponse force microscopy

Abstract:
Dynamics of ferroelectric domain switching are characterized in BiFeO3 thin films for interfaces of varying orientation. Piezo Force Microscopy is commonly used for such nanoscale domain studies, but practical limitations on imaging speeds limit its application for dynamic studies. In this work a new method, high speed PFM (HSPFM), is applied to investigate dynamic processes such as switching, charge dissipation, and domain wall motion. Uniquely, measurements are performed with high-speed PFM, allowing complete image acquisition with standard resolution (256x256 pixels) in less than 3 seconds. The influence on domain switching of interfaces of varying orientation is presented for BiFeO3 films grown on (100) and (111) SrTiO3 substrates. Based on movies of hundreds of such images, domain nucleation and growth of epitaxial BiFeO3 films are presented and exhibit a profound asymmetry in domain switching mechanisms.

Speaker: Chunguang Tang

Advisor: Dr. Rampi Ramprasad

Bio: BS: University of Science and Technology Beijing, China (mainland)
Major in physical metallurgy
Worked for Xiangtan (pronounced as Shiangtan) Iron Steel Co. for 5 years
MS: National University of Singapore, Singapore
Major in materials science
Joined UConn in Aug. 2005 and now working with Prof. Ramprasad.

Topic: Diffusion of O defects near Si:HfO2 interfaces: An ab initio investigation

Abstract:
Device miniaturization in the microelectronic industry requires the replacement of SiO2 by high-permittivity materials such as HfO2 and ZrO2. While HfO2 and ZrO2 are expected to be thermodynamically stable on Si, undesired interfacial phases such as silicides, silicates and silica are known to form. In this work we investigated the formation and migration energies of O defects in Si: HfO2 heterostructures by first principles modeling, and found that the segregation of O defects provides a mechanism for such interfacial phase formation.

Speaker: Shan Zhong

Advisor: Dr. Pamir Alpay

Bio: Shan Zhong received the B.Sc. degree in materials science and engineering from Shanghai Jiao Tong University, Shanghai, China, and the M.Sc. degree in metallurgy and materials engineering from University of Connecticut, Storrs, CT, in 2003 and 2005, respectively. He is currently pursuing his Ph.D. degree in materials science and engineering at the University of Connecticut, Storrs, CT. His research interests include modeling and deposition of ferroelectric superlattices, multilayers and multiferroic thin films. He is a member of the American Physical Society and the Materials Research Society.

Topic: Ferroelectric Multilayers and Heterostructures for High Performance Tunable Microwave Devices Applications

Abstract:
Ferroelectric multilayers and heterostructures have attracted a significant amount of interests in the past decades due to their unique properties compared to their homogenous counterparts. A number of peculiar phenomena, such as gigantic dielectric permittivity, enhanced spontaneous polarizations, high dielectric tunability, and special phase transformation characteristics, have been discovered in various ferroelectric materials heterostructure systems. This study is a theoretical and experimental effort to understand their potential applications in high performance tunable microwave devices. A comprehensive thermodynamic modeling, using Landau-Ginzburg-Devonshire formalism, theory of elasticity, and principles of electrostatics will be developed to analyze the interlayer coupling, interface effect, strain effect in ferroelectric multilayers and heterostructures. The theoretical results will then be employed to guide the fabrications of ferroelectric multilayers with high dielectric tunability, low dielectric loss, and temperature insensitive dielectric permittivity, which have potential applications in next generation tunable microwave devices. With the guidance of theoretical analysis, multilayered Ba1-xSrxTiO3 (BST) films were deposited on Pt coated Si substrates via metalorganic solution deposition. The multilayer heterostructures consisted of three distinct layers of ~220 nm nominal thickness with compositions corresponding to BST 63/37, BST 78/22, and BST 88/12. At room temperature, the heterostructure has a small-signal dielectric permittivity of 360 with a dissipation factor of 0.012 and a dielectric tunability of 65% at 444 kV/cm. These properties exhibited minimal dispersion as a function of temperature ranging from 90 to -10oC.