Issue 01

May 2015

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# Upcoming Events in 2015

9 September 2015, Annual Symposium CEC Center, University of Minnesota

29 May 2015, 5:30 PM Indeed Brewing Company and Taproom 711 NE 15th Ave MPLS

Dinner and discussions (Dates to be determind) at Buca di Beppo (St.Paul)

For more information and dates please check our website

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## <u>Opening Note</u>

Dear MN AVS Friends,

You are reading the first edition of our Chapter Newsletter. In order to keep our members informed about our activities, we have decided to create a newsletter several times a year. In this newsletter you will find out what has been happening in the Chapter. It is a good way to learn about future events such as Chapter meetings, short courses, the annual Fall Symposium, and social events, as well as a way to stay in touch with your fellow members.

We hope to spotlight one or two talented students (either undergraduate or graduate level) in each issue that are performing exciting research related to the mission of the Chapter. We also plan to include short technical articles, highlight vacuum products, list upcoming events, and advertise career opportunities.

If you have any questions or suggestions, or would like to contribute an article or content, please contact our Chief Editor, Amir Soleimanpour (a.m.soleimanpour@gmail.com).

We hope you enjoy reading our first newsletter!

Sincerely, Bill Theilacker Chair

To subscribe, please contact mnavs@avs.org

To advertise in this newsletter, please contact todd.tevogt@gammavacuum.com



# AVS MN

American Vacuum Society- Minnesota Chapter

## Report on AVS Minnesota Chapter Spring Short Courses

The 2015 Spring Short courses were the most successful in memory. On April 23rd, more than 30 students attended two classes held on the Normandale Community College Campus. Alan Taylor had nearly 30 students in his Vacuum Basics class. Seven students attended the Introduction to Leak Testing course taught by Del Smith. **Demand for the Vacuum Basics** course was so great that a second session was scheduled for Thursday, May 7. That course had nearly twenty students enrolled at the time that this was written.

The AVS Minnesota Chapter has partnered for the last few years with the Vacuum and Thin Film Technology program and the Customized Training department at Normandale Community College to offer the short This partnership has courses. proven to be beneficial to all, especially to the students, who are given access to the excellent Normandale facilities as well as instructors with many years of experience in the field.

Suggestions for new courses to offer and additional instructors are welcomed for future short course programs. Plan now to attend one of the short courses that will be offered again in April 2016. Questions can be directed to Del Smith,

delmer.smith@normandale.edu.

# A Summary of Events in 2014/2015

23 April 2015 - AVS Minnesota Chapter Spring Short Courses

26 March 2015 - Dinner and Discussion Meeting Speaker: Amir Gharachorlou, 3M Title: "Surface Science Approach to Atomic Layer Deposition Chemistry"

19 March 2015 - 13th annual Minnesota Technical Symposium (MinnTS), Coordinated by 13 local technical societies

23 October 2014 - Dinner and Discussion Event, Speaker: Bernie Grung, Normandale Community College Title: "An Introduction to Micro Electro Mechanical Systems-MEMS"

18 September 2014 - AVS MN Chapter Annual Symposium Sponsored in part by Medtronic and Physical Electronics

Invited Speakers:

- Klaus Wormuth, University of Minnesota,
  " Surface Characterization of Drug Delivery Systems"
- Greg Fisher, Physical Electronics, "TOF-SIMS Characterization of Biological Systems"
- Wayne Jennings, Case Western Reserve University,
  "PdSn Nanoparticle Characterization by Auger and TOF-SIMS"
- Russ Holmes, University of Minnesota,
  " Recent Advances in OLED Films"
- Angus Rockett, Univeristy of Illinois @ Urbana Champaign, "Surface Analysis of Chalcopyrite Semiconductors for Photovoltaic Applications"
- Mark Breyen, Medtronic,
  "Materials Needs in the Medical Device Industry"

23 August 2014 - Summer Social Outing Event, Brit's Pub

# 29 May 2014 - Dinner and Discussion Event, Speaker: Amir Masoud Soleimanpour, Tru Vue

Title: "State of the Art - Nanocrystalline Metal Oxide Gas Sensors"

**27 March 2014 - MinnTS : 12<sup>th</sup> Annual Minnesota Technical Symposium** Coordinated by 13 local technical societies

13 February 2014 - Dinner and Discussion Event, Speaker : Ali Rafati, 3M

Title: "Characterization of Challenging Spherical Surfaces"

### FEATURED ARTICLE

Depth Profiling of OLED Materials using XPS with Gas Cluster Ion Beam (GCIB) Sputtering

By: Scott Bryan, Physical Electronics

Up until very recently, depth profiling by XPS or TOF-SIMS was only possible on inorganic materials. Although organic materials could be depth profiled, the ion beam induced damage was so extensive that only elemental profiles could be obtained. That situation has completely changed today due to the commercialization of cluster ion beams, such  $Ar_n^+$  (where n = 1,000 to 4,000), which are capable of sputtering organic materials with very little damage to the underlying molecular structure. The development of GCIB for thin film depth profiling has coincided with the rapid development of organic materials for electronic applications such as Organic Light Emitting Diodes (OLED's) and Organic Photovoltaics (OPV's).

In collaboration between Physical Electronics and Prof. Russ Holmes group at the University of Minnesota, XPS with GCIB sputtering was used to measure the depth profiles of each component in 100 nm thick OLED emissive layers [1]. This provided the first direct evidence that the actual composition matched the intended deposition profiles and relative concentrations. An example of an XPS depth profile is shown in Figure below. Due to the well-established link between film composition and device performance, it is important to have methods to quantify composition profiles in both as-deposited and aged devices.





### <u>Featured</u> <u>Student from</u> <u>MN AVS Student</u> Chapter



Christopher Cheng senior is а undergraduate the University at of Minnesota, Twin Cities, double majoring in Materials Engineering and Chemistry. His research interest lies in thin films, particularly those involved with touchscreen and semiconductor/solar cell applications, which he hopes to continue to graduate school and eventually industry. When not hammered with deadlines and

assignments Christopher enjoys swimming, football, and writing novels that he hopes will get published in the future.

Currently, he is working with Dr. Bharat Jalan in his molecular beam epitaxy lab, helping grow and characterize perovskite oxide and heterostructure thin films. In particular, he is working closely with graduate student Abhinav Prakash as part of an effort to understand the structure of barium stannate (BaSnO<sub>3</sub>) at different MBE operating systems and characterizing them from their thickness via X-ray reflectivity to understand the quality of the film via rocking curves and AFM. Molecular beam epitaxy, to date, yields the highest quality semiconductors, with excellent doping and is capable of growing films one atom thick. Barium stannate interested Christopher because BaSnO<sub>3</sub> yielded some of the highest mobility amongst perovskites at room temperature, yet the cause as to how and why barium stannate can achieve such a mobility is still debated. In addition, he has been working on animation simulations of molecular beam epitaxy and optimizing code to fit X-ray diffraction reflectivity behaviors.



http://www.avs.org/chapters/minnesota

## Featured Project from MN AVS Student Member

Peng (Andrew) Xu, is a Ph.D. candidate in Department of Chemical Engineering and Materials Science at the University of Minnesota.

#### **Research Project:**

Rare earth titanate (RTiO<sub>3</sub>, where R is a rare earth element) thin films and heterostructures have recently drawn great attention, due to many intriguing interfacial phenomena, such as twodimensional electron gas and superconductivity. Andrew is currently working on the growth of NdTiO<sub>3</sub> films using the hybrid molecular beam epitaxy. This approach combines the advantages of solid source and chemical beam MBE by





supplying Nd from an elemental metal source and Ti and O from a chemical precursor titanium isopropoxide. As shown in the scanning transmission electron microscopy image above, an excellent structural quality multilayer of NdTiO<sub>3</sub>/SrTiO<sub>3</sub> can be grown with atomically sharp interfaces. An interesting aspect of Andrew's research focuses on the study of unusual electrical conduction that exists at interfaces between these two insulating oxides. Andrew has recently shown that defects in materials play an important role and should not be underestimated for the study of intrinsic materials physics. For example, he showed that even a small amount of non-stoichiometric cation defect in these materials could have a significant influence on their electronic transport properties. He published this work in Applied Physics Letters (P. Xu, D. Phelan, J. S. Jeong, K. A. Mkhoyan, and B. Jalan, "Stoichiometry-driven Metal-to-Insulator Transition in NdTiO<sub>3</sub>/SrTiO<sub>3</sub> Heterostructures", Appl. Phys. Lett. 104, 082109 (2014).).



#### NORMANDALE COMMUNITY COLLEGE'S VACUUM AND THIN FILM TECHNOLOGY PROGRAM

From the Hadron Collider to the fastest microprocessors, vacuum equipment systems make advances possible in much of today's cutting-edge science and manufacturing technology. Normandale Community College's Vacuum and Thin Film Technology program will give you a path to an exciting career in the world of high-tech.

Normandale's 2-year degree can lead to a career (with starting salaries ranging from \$40K-\$55K) as a maintenance technician, process technician, or research technician. Our certificates will enhance your credentials in science, engineering, or technology.

#### WHERE DO OUR GRADS WORK?

Industries that produce high speed memory devices, electronic parts for aerospace and automotive applications, guidance systems for aviation, wear-resistant tool coatings, and the ultrahigh vacuum pumps used for leading-edge research in physics and medicine.

#### ARE YOU READY TO GET STARTED?

Call 952-358-8200 (1-800-481-5412), or email program chair Nancy Louwagie at Nancy.Louwagie@normandale.edu or check us out at www.normandale.edu/vactech or watch our program video at www.normandale.edu/vacvideo