



**NCCAUS Thin Film Users Group (TFUG)
Meeting
"METROLOGY: OVERVIEW and
ADVANCES"
October 17, 2019**

Location/Date/Time

**SEMI Global
Headquarters
(new address)**

673 South Milpitas Blvd.
Milpitas, CA 95035

**Thurs. Oct. 17, 2019
12:30-3:00 p.m.**

Our Links...

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FREE, No Registration Needed, Just Show Up!

Free lunch provided by:
[Kurt J. Lesker Company](#)

Coffee provided by:
[UC Components](#)

Organizing Committee:

Robert Kertayasa, rolinktech@yahoo.com

Cesar Clavero, Cesar.Clavero@intermolecular.com

Michael Oye, moye@ucsc.edu

Jacques Matteau

Mayu Yamamura

Zoran Mistic

Carolyn Grewel

First-ever NCCAUS TFUG meeting focused on Metrology, including optical inspection of transparent materials,

hyperspectral infrared characterization, SIMS, and other advances for thin film technologies.

Meeting website: [link](#)

AGENDA:

12:30 pm: FREE COFFEE & LUNCH (first come, first serve)

1:00 pm: *Hyperspectral Infrared Characterization of Extremely Thin Films with 10nm Spatial Resolution*
Sung Park, PhD, *President, Molecular Vista*

1:30 pm: *Optical Inspection of Transparent Materials*
Steve Meeks, PhD, *President, Lumina Instruments*

2:00 pm: *Materials Discovery Acceleration Through Advanced Metrology and Machine Learning*
Cesar Clavero, PhD, *Head of Advanced Characterization at Intermolecular Inc., a subsidiary of Merck KGaA, Darmstadt, Germany*

2:30 pm: *Use of Secondary Ion Mass Spectrometry (SIMS) as a thin film characterization tool*, **Jeff Mayer, PhD**, *EAG Laboratories, Eurofins Materials Science*

ABSTRACTS AND BIOS:

Hyperspectral Infrared Characterization of Extremely Thin Films with 10nm Spatial Resolution
Sung Park, PhD, *President, Molecular Vista*

Extremely thin films of materials such as self-assembled monolayers (SAM), graphene and other 1D/2D materials, and layers from atomic layer deposition are difficult to characterize with existing optical or electron-based techniques especially if they are confined to small geometries. A relatively new hyperspectral technique called photo-induced force microscopy (PiFM), which provides monolayer sensitivity and sub-10nm spatial resolution in infrared spectroscopy, will be presented. By combining optical spectroscopy with atomic force microscopy, PiFM can

acquire both chemical information and topography on organic and inorganic samples with sub-10nm resolution.

Bio: Sung is the CEO of Molecular Vista, which he co-founded with Prof. Kumar Wickramasinghe (UC Irvine, formerly of IBM) in 2011 to provide research and industrial tools for rapid and nanoscale imaging with chemical identification. Sung has over 25 years of experience of industrial R&D, engineering, marketing and sales, and operations. In the scanning probe field, he co-founded Park Scientific Instruments (PSI), which was one of the first commercial companies to develop and sell scanning tunneling microscopes (STM) and atomic force microscopes (AFM). Prior to founding Park Scientific Instruments, he worked as a post-doc at IBM Watson Research Center. Sung earned his Ph.D. in Applied Physics from Stanford University and BA in Physics from Pomona College.

Optical Inspection of Transparent Materials
Steve Meeks, PhD, President, Lumina Instruments

There has been a recent growth of interest in glass (and other transparent materials) for use as interposers for advanced packaging. Large (500 x 500 mm) glass panels are being considered for Fan Out Panel Level Packaging (FOPLP). Glass has many advantages when used in a semiconductor process such as: low electrical loss, tunable coefficient of thermal expansion, and a substrate area which is greater than 3x that of a 300 mm wafer. For all of the advantages of glass it has some challenges in the development of interposer technology. One major issue is the inspection of glass for organic residue (and other defects) which remain on its surface after the glass has been processed. Surface residue on glass can have a dramatic effect upon the ability to bond glass to other substrates. The transparency of glass is generally a virtue but to the inspection scientist it represents a challenge. This talk will present a solution to the problem of inspecting a transparent surface for sub nanometer films of organic residue. Several examples will be presented including the detection of sub nanometer wash stains on 100-micron thick, 150 mm diameter interposer glass substrate. Another example is the organic residue left after removal of protective films which are used to prevent mechanical damage to glass surfaces.

Bio: Steven Meeks, President Lumina Instruments. Ph.D. Applied Physics Stanford Univ. More than 20 years experience in instrumentation development. Co-founder and CTO of Candela Instruments, VP of Technology at KLA-Tencor, 50+ patents. <http://www.lumina-inst.com/>

***Materials Discovery Acceleration Through Advanced Metrology and Machine Learning
Cesar Clavero, PhD, Head of Advanced Characterization at Intermolecular Inc., a subsidiary of Merck KGaA, Darmstadt, Germany***

Pushing further the performance of electronic devices and clean energy technologies, to name a few, requires rapid materials discovery. It is thus important to find ways to accelerate this process, allowing the screening of wider compositional and process spaces, shortening the discovery-to-production times and ultimately reducing R&D costs. In the last years, high throughput experimentation, encompassing combinatorial process and automated metrology, has enabled the production of high volumes of data in short periods of time, making the analysis and learning extraction process very challenging. In this context, automated data processing, analysis and database creation are now central parts of the research process. Furthermore, machine learning has proven to be an extremely efficient tool to help disentangling the mechanisms driving the observed trends, and ultimately guiding further steps in the experimental process. We will discuss some practical examples of this new paradigm.

Bio: Dr. Cesar Clavero holds a PhD in Condensed Matter Physics and has over 17 years of Material Science research experience in academia, national laboratory and industry. In 2012, he joined Lawrence Berkeley National Laboratory (California, USA) as staff scientist in the Plasma Applications Group. In 2014 Dr. Clavero joined Intermolecular, where he currently leads the Advanced Characterization Mechanism Understanding Team, supervising the Metrology and Electrical Test teams. Dr. Clavero has 52 publications in high-profile peer reviewed journals, two book chapters and 8 patents.

Use of Secondary Ion Mass Spectrometry (SIMS) as a thin film characterization tool

Jeff Mayer, PhD, EAG Laboratories, Eurofins Materials Science

Dynamic SIMS has been used for the past 50 years to measure dopants and trace level contamination in bulk materials. The semiconductor industry, in particular, has made great use of SIMS as an R/D tool.

Every new generation on the ITRS requires ion implant modeling and SIMS provides the input for those models. The same SIMS tools which provide ppb and ppt calibration can also be optimized to measure composition and characterize very thin films. This talk will present some of the background development in thin film characterization by SIMS and discuss applications in gate oxides and various ALD films.

All presentations will be requested to be posted on the TFUG Proceedings webpage.

If you would like to sponsor a User Group meeting, please check out the "NCCA VS Sponsorship Opportunities" at:

<https://nccavs-usergroups.avs.org/wp-content/uploads/2017/08/UG-Sponsor.pdf>

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