NCCAVS – TFUG Meeting
www.avsusergroups.org

Topic: Advanced Memory

Meeting Date: Noveber 14, 2019

Time: 12:30 - 3:30 p.m.

Location: SEMI Global Headquarters
673 South Milpitas Blvd.
Milpitas, CA 95035

FREE TO ATTEND, JUST SHOW UP!

****

SPONSORED BY:
Kurt J. Lesker Company
UC Components

****

ORGANIZING COMMITTEE
Chakku Gopalan, cgopalan@micron.com
Chari Perera, charitha_perera@amat.com
Cesar Clavero, Cesar.Clavero@intermolecular.com
Deepak Kamalanathan, deepak_kamalanathan@amat.com
Michael Oye, moye@ucsc.edu
Suketu Parikh, Suketu_parikh@amat.com

SPEAKERS/AGENDA

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

1:00 pm: Recent Trends in Semiconductor Memory, Bob Gleixner, Micron Technology, Inc

1:30 pm: ALD Chalcogenide : A Key Player for Next Generation Crosspoint Memory, Mario Laudato Ph.D**,** Intermolecular Inc., a subsidiary of Merck KgaA, Darmstadt, Germany

2:00 pm: RERAM Engineering for Neuromorphic Computing, Siddarth Krishnan, Applied Materials

2:30 pm: New PVD System for Advanced Memory Applications*,* Wei Chen Ph.D, Applied Materials

3:00 pm: Materials Metrology for Advanced Memory*,* Srini Rangarajan Ph.D*,* Nova Measuring Instruments

Abstracts and Bios

Recent Trends in Semiconductor Memory, Bob Gleixner, Micron Technology, Inc.

The exponentially increasing volume of data that is processed, communicated, and stored has driven a similar expansion in the market for semiconductor memory. The vast majority of this demand has been fulfilled by two technologies, DRAM and NAND flash. At the same time, an opportunity has arisen to bridge the 100X speed/cost gap between fast, expensive, volatile DRAM and slow, cheaper, nonvolatile NAND. The memory architecture between these two, frequently referred to as storage-class memory (SCM), combines the non-volatility and low-cost of NAND with the access speed of DRAM. Much of the activity to implement a SCM has centered on the development of new memory cell technologies, generally referred to as emerging memories. Emerging memories have employed a variety of mechanisms to store data, including magnetic polarization, ferroelectric polarization, and resistivity. This presentation reviews the characteristics required for a successful SCM, with a focus on phase change memory (PCM) and the cross-point architecture.

Biography:
Bob Gleixner is a Distinguished Member of Technical Staff with Micron's Technology Development team in San Jose, CA. He received his B.S. degree from Cornell University and his M.S and Ph.D. degrees from Stanford University, all in Materials Science and Engineering. He joined Intel's logic technology group in 1998 and for the next 10 years focused on reliability of semiconductor logic, memory, and microdisplay devices. In 2004 he started working on phase change memory, leading the reliability team that released the first high-density production component in 2010. In 2008 he joined Numonyx (a spin-off from Intel and ST Micro) and in 2010 joined Micron Technologies as part of the Numonyx acquisition. Bob continues to work on emerging non-volatile memory technologies with a focus on understanding, modeling, and improving performance and reliability to achieve production-capable devices.

ALD Chalcogenide: A Key Player for Next Generation Crosspoint Memory, Mario Laudato Ph.D, Intermolecular Inc., a subsidiary of Merck KGaA Darmstadt, Germany

Chalcogenide materials have played in the last decade a crucial role for the development of crosspoint memory product. In fact, these materials are exploited to produce ultra-fast ovonic threshold switches (OTSs) with good selectivity and very low leakage current and phase change memories (PCMs) with excellent endurance, stable resistance window and short read/write times when compared with state-of-the-art FLASH-NANDs. The combination of these two fundamental elements is used to fabricate 3D crosspoint arrays with a write/access time orders of magnitude shorter than state of the art flash-NANDs. 3D crosspoint architecture allows for very high density memory integration having a pivotal role for the advancement of fields such as artificial intelligence (AI), machine learning (ML), and big-data. Chalcogenide materials, at the moment, are deposited by using physical vapor deposition (PVD) techniques that allow for fine control over the stoichiometry of the thin film, but fail in providing the conformality required for developing large memory-capacity integrated 3D structures on multiple decks. Here we present an approach to deposit ALD binary germanium-selenium (GeSe) and germanium-tellurium (GeTe) spanning a wide range of compositions for OTS application and ternary germanium-antimony-tellurium (GST) for PCM application. The ALD GeSe and GeTe films show excellent conformality, low surface roughness, and good compositional homogeneity, allowing for the integration of low leakage devices with threshold voltage tuning achieved by control over the film composition. Ge2Sb2Te5 ALD PCM exhibit a wide memory window exceeding two-orders of- magnitude, short write times (~ 100 ns), and a reset current density as low as ~ 107 A/cm2 - performance matching or improving over state of the art PVD PCM devices.

Biography:
Mario Laudato received the M.S. and Ph.D. degrees in electrical engineering from Politecnico di Milano, Milan, Italy, in 2014 and 2018, respectively. He has worked as postdoctoral researcher at Politecnico di Milano in the NanoDeviceLab led by Prof. Ielmini, focusing his study on non volatile emerging memories (PCM and RRAM) and select devices for high density crosspoint memory and neuromorphic computing. Now he is working as Device Engineer III at Intermolecular Inc. in San Jose, CA, focusing his work on ALD chalcogenide-based emerging memories and selectors for high-density crosspoint memory application.

RERAM Engineering for Neuromorphic Computing, Siddarth Krishnan, Applied Materials

As CMOS technology scaling slows down and cost goes up quicker than transistor density, alternative computing architectures, such as neuromorphic computing, have been introduced that help speed up computing. While these new computing paradigms eschew the traditional "memory wall" bottlenecks, the materials engineering required for creating robust, reliable, scalable products is still infantile in its lifecycle. This, in turn, has spawned tremendous interest in several non-volatile memories such as Phase Change Memory, Conductive Bridge Memory, Oxygen Vacancy mediated RAM(ReRAM) and Magnetic RAM (MRAM) . Applied Materials has made key advances in the engineering of these materials with a) The recent introduction of several tools for MRAM and ReRAM b) Expansions in device and design technologies to assist in engineering the materials. This talk will focus on some of the recent advancements made by Applied Materials on engineering ReRAM for Neuromorphic Computing.

Biography:

Siddarth Krishnan is ideally suited to be in Silicon Valley, having done a Bachelors degree in Metallurgical Engineering from IIT Madras, a Masters in Materials Engineering and a Ph.d in Electrical and Computer Engineering, both from the University of Texas at Austin. After dabbling a tiny bit in digital design, Siddarth joined IBM SRDC (Semiconductor R&D Coop) as a Module Device and Reliability Engineer and spent the better part of a decade in engineering the gatestack and its reliability for introduction into IBM's 32nm, 22nm and 14nm product lines. During his time there, he also helped introduce HfO_2 and metal fill for use in an embedded DRAM and decoupling capacitor that are also used in IBM's server products. Siddarth moved his family, kicking and screaming, from New York to California to work at Applied Materials, where he has spent the last 4 years. After spending a few years developing Atomic Layer Deposition (ALD) products for AMAT's MDP business unit, he has spent the last couple of years working on engineering materials for emerging technologies in advanced memory and power devices. Siddarth is super stoked to talk about some of Applied Materials' latest research efforts at this meeting.

New PVD System for Advanced Memory Applications, Wei Chen Ph.D, Applied Materials

A surge in data generation combined with the slowdown in Moore's Law scaling is driving the need for higher computing efficiency both at the chip and system level, where memory is playing an ever-increasing role. New memory technologies like MRAM, PCRAM, and ReRAM are gaining more tractions in the pursuit of higher efficiency computing. Achieving the high volume manufacturing of these new memory technologies requires both material innovations and atomic-level precision control. This presentation will review the key deposition challenges of various thin-film materials involved in these new memory technologies, and how Clover multi-cathode and Impulse pulse-DC chamber technologies are designed to overcome such challenges. In particular, the integrated solution for the multilayer film stack for MRAM will be presented together with the unique approach to achieving high-quality MgO tunnel barriers with low defects for high volume manufacturing.

Biography:
Wei Chen is currently a global product manager in Metal Deposition Products business unit of Applied Materials. Prior to joining Applied, he worked briefly as a Senior Technical Staff Member for MRAM stack development at Spin Memory in Fremont, CA. Prior to that, he worked in the emerging memory group of Micron Technology as a Senior Engineer on thin-film material development for MRAM and DRAM. Before his time in Micron, he was a design engineer of Magnetic Tunnel Junctions for hard disk drive in the read head design group of Western Digital. Dr. Chen received a Ph.D. degree in Physics from the University of Virginia and a B.S. degree in Physics from Nanjing University. He holds 10 US. patents and co-authored 10+ journal publications in the field of magnetic thin-film material and device technology.

Materials Metrology for Advanced Memory, Srini Rangarajan Ph.D, Nova Measuring Instruments

Advancements in memory technology are being powered not only by dimensional scaling but in large part by materials scaling. As devices are being built using many new chemical elements stacked into smaller spaces, controlling that process requires advanced metrology. One obvious solution is to develop complex lab characterization technologies for a mass fabrication environment. Nova measuring instruments has specialized in this area of making novel characterization techniques accessible to process engineers in the fab. This talk delves into some of these techniques being employed for yield learning in advanced memory fabs.

Biography: *Srini Rangarajan is the Applications Manager of the Materials metrology division of Nova Measuring Instruments in Fremont, CA. He has a PhD in Materials Science from SUNY at Stony Brook and was an Advisory Engineer for Metrology at IBM Fishkill before moving to the Bay Area to ReVera Inc. He has a vast experience in thin films metrology starting from 130nm to now 7nm and 5nm.*

****

All presentations will be requested to be posted on the TFUG Proceedings webpage approximately 1-2 weeks following the meeting.

If you would like to sponsor a user group meeting please check out the
NCCAVS User Groups Marketing Opportunities