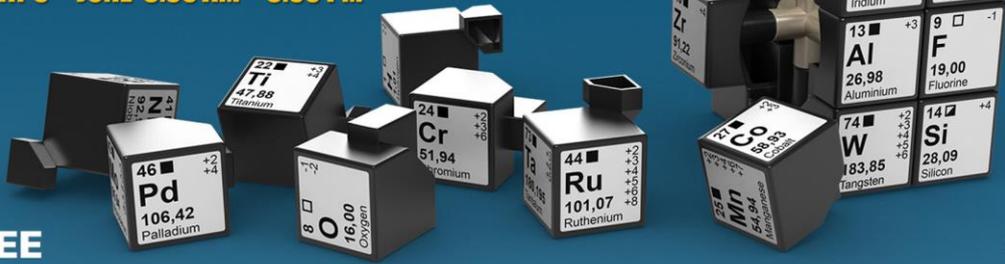


**WORKSHOP ON MATERIALS IN THE SEMICONDUCTOR
INDUSTRY: *Solving the Puzzle***
MONDAY 3RD JUNE 8:30 AM – 5:00 PM



Secure your seat as 8 industry and academic leaders guide you to Solve the Puzzle. Attendance to the workshop is free for all conference registrants.

As time goes, more and more materials are considered, evaluated, and then used in production in the semiconductor industry. This trend started about 1 to 2 decades ago when dimension scaling showed signs of a to slow down and it is accentuated today as more and more applications build up on the semiconductor field. In this workshop, leading scientists and innovators will review the materials evolution in the industry, looking at trends in the logic, memory, packaging, IoT and power areas. They will also address the associated metrology and sustainability challenges when introducing these new materials.

08:30 - 08:45

Welcome and Introduction

Pierre Fazan, *Micron*

08:45 - 09:30

New Materials – Everything's on the Table

Ivo J. Raaijmakers, *Chief Technology Officer and Corporate VP of R&D, ASM International N.V., Almere, the Netherlands*

Semiconductors continue to scale using three dimensions of innovation: new architectures, new processes, and new materials. Although the time it takes to introduce a significantly new material into mainstream semiconductor manufacturing has not changed that much, the breadth of new materials development has widened. Equipment and materials suppliers have taken on a leading role to drive innovation along the process and materials axis.

09:30 - 10:15

Logic Technology Materials

Szuya Sandy Liao, *Logic Technology Development, Intel Corporation, Hillsboro, OR, USA*

The continued scaling of MOSFETs for leading-edge logic technology has driven the industry toward a number of major technological innovations, including material and process changes such as strained silicon, higher-k gate dielectrics and the state-of-the-art FinFET technology. This talk first reviews the materials used in logic devices, and then discusses opportunities and challenges in applying novel materials on complex 3D structures of future technology with ever decreasing dimensions.

10:15 - 10:45

AM Break



10:45 - 11:30

The Memory Futures

Gurtej S Sandhu, *Senior fellow, Micron Technology Inc., Boise, ID, USA*

The dominant memory chip technologies such as NAND Flash and DRAM are faced with scaling slowdown. 3D NAND and 3D DRAM chip stacking is enabling new applications and markets. In addition, several flavors of new memory technologies based on alternate state variables are under development. This presentation will give an overview of some of the most promising candidates. There has been progression in the vision for emerging memory in the last decade and some of the factors which will likely determine compelling value and motivation for adoption in the market place will be discussed.

11:30 - 12:15

Materials in electronic device interconnect and packaging: Less is More

Eric Beyne, *imec Fellow, Program Director 3D System Integration, imec, Leuven, Belgium*

The field of semiconductor packaging has seen significant changes in the past decades. From being mainly a means to protect the silicon die from environmental reliability hazards to becoming a circuit performance limiting factor. Initial chip packaging relied heavily on metal and ceramic technologies, using refractory and noble metals as interconnect. Driven by a strong need to improve cost and miniaturize packages, technology shifted from ceramic to organic materials. In particular the development of high purity organic compounds in the 80's and 90's allowed for highly reliable products, without the requirement of "hermetic" metal and ceramic packaging. Increased environmental consciousness and in particular the European Union ROHS-directive (Restriction of Hazardous Substances) resulted in a revolution in electronic packaging. In particular the move to lead-free solder and a ban on some flame retardants posed significant challenges to the Industry. Driven by the need to miniaturize electronic systems, while reducing cost, the industry continues to reduce its use of materials and increased used of advanced organic materials. So in the end, less is more...

12:15 - 13:15

Lunch

13:15 - 13:45

Mendeleev Table, an enlarging playground for IoT

Benedetto Vigna, *President Analog, MEMS and Sensors Group, ST Microelectronics, Agrate, Italy*

Sensors are all around us: they are in cars, in smartphones, in factories, in pacemakers, in drones, in smart speakers and in many other places with the ultimate goal to sense and to monitor parameters of importance and interest in our daily environment. They play an essential bridge between electronic systems and the user or environment. Today they already enable a multibillion dollar industry with many applications in automotive, consumer and personal electronics. In these days we are unconscious spectators and/or conscious actors in the development of many new applications classified under the wide umbrella of "Internet of Things". Different type of sensors and energy sources, together with microncontrollers, analog, power management and wireless chips are the main hardware building blocks of the nodes that enable the IoT business. The need to enrich the sensorial dimensions of the nodes as well as the need to make them more energy efficient, is the reason why different elements of the Mendeleev table get the attention of the companies developing hardware for IoT. After an extensive look-back over the current situation, this talk will address the next element candidates meant to be embedded in next generation IoT nodes."



14:00 - 14:45

Materials propelling the power electronics

Cem Basceri, *President & CEO Qromis Inc., Santa Clara, CA, USA*

The technical and roadmap requirements that must be met by power electronics continue to push the existing materials which are used to fabricate such devices to their absolute limits, as in other semiconductor technologies. The power electronics manufacturers have been aware that, despite the heroic developments in mainstream Si-based device technologies, new materials are needed to continue addressing the ever-advancing requirements of the next generation power electronics and applications. Presently, SiC- and GaN-based high-performing power devices are under heavy development with an effort to increase their market adoption, and more exotic materials such as Ga₂O₃ and diamond are being researched for demonstrating fundamental device capabilities and potential commercial use in future. The presence of many materials contenders and device designs in this important field requires a very systematic and sophisticated evaluation of the fundamental properties of these core semiconductor device materials and their commercial applicability for achieving the critical power device roadmap performance goals. In this talk, we will present all the key materials for advanced power electronic devices, including the opportunities and the challenges, starting from the fundamental materials properties of core semiconductor materials' breakdown-field, mobility and thermal conductivity, as well as the critical surrounding materials used in e.g. metallization, passivation, and doping which are traditionally considered as the elements of device fabrication technology. Further, we will discuss the materials aspects of QROMIS' newly developed disruptive and commercial QST® substrate and GaN-on-QST® device technology solutions, and also how such solutions address the key technical, cost and scalability challenges for accelerating the GaN-based power electronics adoption.

14:45 - 15:15

PM Break

15:15 - 16:00

Characterization challenges for the semiconductor industry

Narciso Gambacorti, *Program Manager, CEA-Leti, Grenoble, France*

Some more recent developments concerning material and device characterization for the semiconductor industry will be presented. In particular, some examples will be presented concerning, logic devices, new memory materials, packaging, organic electronic and power devices.

16:00 - 16:45

Sustainable approaches in IoT devices

Thierry Baron, *Executive director of LTM- CNRS -UGA, Grenoble, France*

The access to raw materials is an economic and major geopolitical stake for the 21st century. Some key elements considered today in the emerging devices for the Internet of Things (IoT) must be substituted or saved in a drastic way in the near future. In this contribution, we will show routes to develop processes either to save or substitute critical materials to realize specific functions such as light emission and detection, and sensors with technologies compatible with large-scale integration.

16:45 - 17:00

Final reflections

Pierre Fazan, *Micron*

17:00

Workshop Ends

