Strategic Materials Conference

D. Guerrero
Senior Technologist
Brewer Science, Inc., Semiconductor Business Unit, Leuven, Belgium

Biography

Douglas Guerrero received a PhD in Organic Chemistry from the University of Oklahoma, USA. After a post-doctoral appointment at the University of Texas - Dallas, he joined Brewer Science in 1995 and where he is a Senior Technologist in the Semiconductor Materials Business Unit. Dr. Guerrero is a Senior Member of SPIE and currently serves in the SPIE Advance Lithography and the International Symposium on DSA committees. He has over 60 publications and patents in the field of lithography. He is currently on assignment at imec in Leuven, Belgium where he is responsible for patterning process development using immersion, Directed Self-assembly and EUV lithography.

Are Materials still interesting to successful manufacturing of Semiconductors?

S. Weiher
Sr. Director TD, GLOBALFOUNDRIES Fab 1
GLOBALFOUNDRIES, Technology Development, Dresden, Germany

Abstract

Semiconductors remain a fast growing market worldwide. Since 30 years, there has been revenue increases by ~ 10% yoy. Looking at the segments, memory/logic remain strong, while sensors and opto-electronics are growing. Technology scaling towards smaller structures and larger wafers is driving up costs and investments, and many semiconductor manufacturers cannot afford to pursue the smaller scale. In memory, consolidation of manufacturers who drive DRAM and Flash developments is done. Also, regionally China and America are growing, Japan and Europe are losing share. The focus of this paper is the impact materials play in this changing business.
Interestingly, no technology or wafer size has disappeared from the manufacturing landscape in the last 20 years. Due to product longevity and the addition of new features and functionalities to those existing bases, high voltage, non-volatile memories, RF, Si photonics, to name a few, the products meet the demand but it is clear that these new emerging applications will drive specific demands on material development.
Another perspective is that increased quality in yield and reliability drives material suppliers to provide enhancements in defectivity and quality controls. A minor quality loss can lead to massive wafer supply risk if reliability or yield is impacted. And Europe's semiconductor industry faces a competitive disadvantage over other regions of the world. Europe's EHS

compliance and chemical legislation (EU REACH, RoHS) regulate materials differently to other manufacturing geographies. In some cases, this EU regulatory landscape drives the development of alternative materials. As China brings the mega-fabs online with the advantages they have (funding, regulations, captive customers), we will be forced to make the solutions cost effective.
The demand for new materials, the requirements for superior qualify and necessity of solutions for EHS pressures will drive inventive solutions at the forefront of this business.

Biography
Dr. Susan Weiher received her PhD from Stanford University in 1991 in Chemical Engineering, focused on Substrate driven reactions in vacuum environments. she chose a career in the Semiconductor equipment manufacturing right after completing her degree and at the beginning of significant advances in technology capability and Silicon Chip demand. In 1994 she move to Europe, specifically Germany. After 22 years in the equipment side of the business, she took on the opportunity to move to the manufacturing of chips, and managed the Manufacturing Engineering team of a major European Semiconductor fab in Germany. Since January 2018, she holds responsibility for the technology development (TD) group within Europe's largest foundry.

Wafer for More than Moore applications is becoming a major market

J.-C. Eloy
President and CEO
Yole Développement, Lyon, France

Abstract
Wafer demand (including MEMS & sensors, CIS, and power, along with RF devices) for More than Moore (MtM) reached almost 45 million 8-inch eq wafers in 2017. Wafer demand is expected to reach more than 66 million 8-inch eq wafers by 2023, with an almost 10% CAGR2017 - 2023. Numerous megatrend market drivers will contribute to MtM devices' growth : 5G (wireless infrastructure & mobile), mobile (including additional functionalities), voice processing, smart automotive, and Augmented Reality/Virtual Reality (AR/VR), artificial intelligence. Regarding semiconductor material, although silicon is by far the most dominant, alternative non-silicon-based substrates like SiGe, GaAs, GaN, and SiC are increasing their importance within the MtM industry. Choosing the right substrate technology will strongly depend on the technical performance associated with the megatrends's requirements, as well as the cost.The presentation will highlight the market trends and the impact on the wafer start for the different wafer substrates.

Biography
Jean-Christophe Eloy is CEO and Founder of Yole Développement, the "More than Moore" market research and strategy consulting company. Since 1991, he has been involved in the analysis of the evolution of MEMS markets at device, equipment and also materials suppliers' level. Jean-Christophe Eloy is also board member in several organisations in Europe and in North America.

2018 Semiconductor Materials Markets: Where are they Headed?

L. Chamness
Senior Market Analyst Manager
SEMI, Industry Research and Statistics, Milpitas, United States

Abstract

2018 is expected to to be a record breaking year for the semiconductor materials market, driven to a large extent by record device shipments. Semiconductor materials suppliers are finding themselves in high demand but how long will it last? This presentation will discuss recent revenue trends and provide a forecast through 2019 for wafer fab and packaging materials.

Biography

Ms. Lara Chamness is a Senior Manager Market Analysis at SEMI® and is responsible for SEMI's data collection programs for equipment and materials. This includes leading interactions with SEMI's participating companies, partners and subscribers. Ms. Chamness has 18 years of industry experience and has BA/MS degrees in environmental sciences and a MBA degree from Santa Clara University.

I. Radu
Director
SOITEC, R&D, BERNIN, France

Biography

Ionut Radu is Director of Advanced R&D at Soitec being responsible for research and development efforts in the field of advanced substrate technologies. Prior to being appointed to his current position, he held various technology management positions with responsibility in development of new substrate technologies for advanced electronic devices. Ionut is currently involved with industrial and academic research collaborations to support strategic developments of advanced substrate materials for semiconductor industry.

Dr. Radu obtained his B.S. in physics from University of Bucharest in 1999 and Ph.D (Dr. rer. nat.) in physics from Martin-Luther University Halle-Wittenberg in 2003. He has co-authored more than 70 papers in peer-reviewed journals, conference proceedings and reference handbooks and holds more than 40 patents in the field of semiconductor technologies. Dr. Radu is senior member of IEEE society and involved in Technical Program Committees of international conferences (ESSDERC, VLSI-TSA) and industrial forums (Semicon Europa).

Engineered Substrates: a powerful co-innovation platform

C. Mazure
EVP and CTO
Soitec, Soitec, BERNIN, France

Abstract

Numerous systems like automotive, IoT and many more require low latency, data processing efficiency, low power requirements, and meta-data transmission. Machine learning must occur at the sensing node. Edge and very edge computing are essential to maintain the high efficiency of a given system, as well as the mechanism to control the overwhelming data generation and subsequent flows. The sequence of sensing, processing the information, learning, and transmitting/receiving data is the sequence that builds on smart microelectronics and smart engineered substrates.

The urgency with which the different applications must innovate imposes a renewal in how the supply chain industry has treated R&D, sampling and solution development. Co-optimization of architecture-technology-engineered substrate made possible the success of RF-SOI for 4G, establishing RF-SOI technology as the incumbent technology.

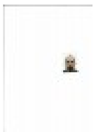
In order to shorten the overall R&D cycle from substrates through systems a co-innovation approach is needed. In a co-innovation strategy the key actors collaborate in early stage at several levels of the value chain to maximize synergy, converge on the substrate-system solutions enabling the fastest time from development through product.

This talk will discuss co-innovation, engineered substrate infrastructure and examples of substrate innovations.

Biography

Dr. Carlos Mazure,
CTO & EVP, Head of Corporate R&D at Soitec since 2001.
Chairman and Executive Director of SOI Industry Consortium since July 2014.
IEEE Fellow, 30 years of experience in Semiconductor Industry.
Prior to Soitec, Carlos headed the ferroelectric FeRAM program at Infineon (Munich, Germany), and initiated Infineon/Toshiba FeRAM Alliance.
Earlier he worked for IBM/Infineon DRAM Alliance (Fishkill, NY); and before at APRDL, Motorola (Austin, Texas).
Carlos holds two doctorates (University Grenoble, France; Technical University Munich, Germany). Authored/co-authored 120+ technical papers, holds 100+ US patents. Member of several international advisory committees and company boards.

Fine Pitch Plating Resist for High Density FO-WLP



J. Serrand
Technical packaging manager
JSR Micro NV, R&D, Leuven, Belgium

Abstract

Abstract— Due to large topographic gaps between the chips and mold substrate, the next generation of high density FO-WLP will require fine RDL plating resists that can achieve as low as 2um line/spaces(L/S) with a wider common depth of focus (DOF) margin. In order to meet these requirements, we developed a novel chemically amplified positive tone resist. In this study, we focused on photo acid generators (PAGs) which are one of the major components of chemically amplified resists. We found that controlling the acidity of the generated acid from PAGs after exposure was a key approach to get good profiles on Cu sputtered substrates and wider DOF margins.
Keywords—Plating resist, FO-WLP, fine RDL, photo acid generators.

Biography

Packaging Technical Manager, Jerome joined JSR in 2002. He is located near Grenoble the French Silicon Valley from where he can give full technical support to many different key customers in Europe. Keeping close contact with the R&D department in Japan and Belgium, he manages and supports several on-going projects at different European customers.

Adhesive & Encapsulation Developments for Advanced Semiconductor Packaging

R. de Wit
EIMEA SU Head Semiconductors
Henkel Electronic Materials NV, Semiconductor Assembly Materials, Westerlo, Belgium

Abstract

Electronics market trends continue to drive innovation for higher functionality with smaller form factors and reduced power consumption. To meet these demands, the design of semiconductor devices is changing more and more from traditional wire bonded packaging to so called “advanced semiconductor packaging“ based on Wafer Level, Flip Chip and 2.5D/3D Stacking technologies. Fan-In and Fan-Out Wafer Level Packaging (WLP) and Through Silicon Vias (TSV) for instance are successfully replacing proven wire bond technology today. This has a significant impact on the typical assembly materials being typically used in the Back End Of Line (BEOL) production of semiconductors. For instance, there’s often no need for die attach adhesives and traditional transfer mold compounds anymore being currently widely used in SO, QFN, QFP and BGA type of lead frame and laminate devices.

This presentation will give a high level overview of the relative new and different assembly materials being developed, qualified and used in “advanced semiconductor packaging“ as such. This includes very thin “Wafer Applied Underfill Films” for 3D Stacking of thin TSV Wafers, specialized “low stress and low warpage” adhesives/underfills for Flip Chip and Interposers and low shrinkage and ultra-low warpage wafer encapsulants for Fan-In and Fan-Out devices. As the proven wire bond technology will certainly continue to be used in high reliability and automotive semiconductors and sensors, also new adhesives with higher thermal conductivity, lower temperature cure, ultra-low modulus and pre-applied “B-stage” capability will pass by ….

Biography

Ruud de Wit is responsible for managing Henkel's Semiconductor Materials business in EIMEA. Ruud has a BSc degree in Mechanical Engineering followed by several polymer, sales and marketing courses. He's working for Henkel since 1990 in multiple positions including technical service, quality engineering and global semiconductor account and product management.

A New Collaborative Approach to Reliability Challenges in the Automotive Industry

A. Amade
Regional Senior Director EMEA
Entegris, Global Sales, Dresden, Germany

Abstract
By 2030, 50% of the car costs are expected to be SC components related. While it is an exciting source of growth for the complete supply chain, the car industry sets a great challenge for all of us: reaching the ppb level in failure rate at the component level. Material purity and contamination control could play key enabler roles. However it requires a new collaborative approach to validate expectations and identify the most adequate investments to meet the “zero defects” goal. From the list of potential material options, there is an increased value to tackle the non-visible particles that are sources of latent defects. Actually, the defectivity monitoring challenges in terms of limit of detection create a “Black Box”. The industry is here in the 3rd generation of contamination control strategy where base line and excursion control could be improved with an adequate contamination management strategy. A collaborative engagement model exists where device makers and experts in purity work together in task force mode. This is the “New Collaborative Approach”.

Biography
Mr. Amade joined Entegris in 1995 as an Application Engineer in its Semiconductor business. In his current role as EMEA Sr. Regional Director, Mr. Amade’s primary responsibilities include growing the semiconductor business in Europe and Middle East through market strategies, and in the management of a sales, customer service and marketing team.

Mr. Amade held leadership positions at Entegris which included: gas microcontamination market management, strategical account management and regional sales management.

Mr. Amade has a degree in Chemical Engineering from ENS Chimie Lille and he is a member of Semi Electronic Materials Group for Europe.

Digitalization and Innovation Transforms Manufacturing and Construction

P. Maris
CEO
Kinetics, Livermore, United States

Abstract
We've developed some new game-changing technologies leveraging 3d computer-aided design, augmented reality, virtual reality, and sophisticated human-machine interfaces. We can discuss how these technologies are changing the way facilities and equipment are designed, built, and operated.

Biography
Peter Maris, Kinetics Systems, Inc.
CEO

An accomplished business leader with over 19 years' experience in the high-technology industry, Peter heads the global business operations for Kinetic Systems, Inc. Peter left a successful 10-year career in the commercial banking industry to join Kinetics in January 2000, first working in Malaysia for its Asian operations. He continued his leadership path shortly thereafter taking over as president for Europe/ME and Asia, before assuming the role of president and CEO in 2010. He is accredited for consolidating Kinetics' international operations and establishing its Saudi Arabian business units. His strategy to drive the business into a process-driven company has transformed Kinetics into "The Process People" it is today, positioning the company as a global leader in total process solutions. Peter's fluency in four languages and strong finance background gives him an edge in working with people and finding common sense solutions in an engineering-driven industry. Under his leadership, the company has continued to deliver double-digit profitable growth over the last few years. Peter holds a BS in economics.

J. W. Bartha
Professor
TU Dresden, EEIT - IHM, Dresden, Germany

Biography
Prof. Dr. Johann W. Bartha received a Diploma and PhD. degree in solid state physics at the University of Hannover, Germany. He was two years Post Doc at the IBM T. J. Watson Research Center Yorktown Heights, N. Y. were he investigated Metal Polyimide interfaces for applications in multi layer ceramic packaging. 1985 he joined the IBM German Manufacturing Technology Center (GMTC) at Sindelfingen Germany as staff member and became responsible for plasma based technologies in semiconductor processing as a senior staff member. 1994 he accepted a C3 professorship at the University of Applied Sciences at Münster, Germany where he established a laboratory for micro manufacturing. 1999 he accepted a C4 professorship as head of the chair for Semiconductor Technology at the Technische Universität Dresden (TUD). Since March 2003 he is director of the Institute of Semiconductor- and Microsystems Technologies at TUD and established a strong collaboration between the Dresden University and the local semiconductor Industry. The research focus at his chair is BEOL processing, 3D integration including electrical and optical TSVs as well as Silicon thin film PV. The search for ultrathin conformal Cu barriers as required in damascene technology initiated the interest in

ALD. In the meantime, the materials studied include high-k dielectrics, moisture barriers, metals, nitrides and graphene. Specific focus is on in-situ and in-vacuo analysis of the nucleation and growth within the ALD processes.

2D materials integration: The long journey from a lab-to-fab environment

S. El Kazzi
Senior Scientist
IMEC, UPM, Heverlee, Belgium

Abstract

During his memorizing lecture “There's Plenty of Room at the Bottom” in 1959, Richard Feynman predicted that surface tension and Van der Walls Forces will be crucially important in the future nanoscale applications. After nearly 60 years, the discovery of Graphene and its related 2D materials are surprisingly confirming these predictions. The use of this family of materials is opening a new era of research innovation in different fields. The imagination of researchers has allowed them to use 2D materials for water treatment, clean energy, (bio)sensing and interesting optical applications. 2D materials are also expected to help in the expected convergence of 5G communications with the Internet of Things (IoT) where faster and connected computers can be achieved by reducing the size of their circuits.
All this fantastic work is however stopped at the proof of concept levels. If these materials would ever see mass production and foundries would accept to have them in their machines, technological solutions to integrate 2D on large area surfaces are fundamental requirements.
In this talk, we will share on our journey to bring these 2D materials from the lab to the fab. The discussion will be first focused on the growth and transfer of 2D materials and how we are trying to understand and solve the main challenges of these Van der Walls materials. An emphasis will be given to the role of surface tension and interface engineering in the making of the 2D-based devices. In a final part, the talk will cover our strategy to integrate 2D materials in a fab production environment while using the learnings from the lab. This work is expected to offer insights on both the main challenges and solutions of MX2 integration for future CMOS technology

Biography

Salim El Kazzi received his Ph.D. degree in micro and nanotechnology, acoustic and telecommunication from IEMN-University of Lille 1 in 2012. His research was focused on the growth of III-(As, Sb) on large area commercial substrates by MBE. After a postdoc position with the MIT-Singapore alliance SMART, he joined IMEC in 2013 as a research scientist responsible on the III-V epitaxy and gate stack deposition by MBE for tunneling devices. In 2015, he started the growth of MX2 semiconductors where he developed the first growth of MX2 by gas-source MBE. He is currently responsible for the large-scale MO-CVD growth of MX2-based materials for beyond CMOS technology

Wide Band Gap Semiconductor Materials - Status and Challenges

J. Friedrich
Department Head
Fraunhofer IISB, Materials, Erlangen, Germany

Abstract
Wide band gap (WBG) semiconductors (SiC, Ga_2O_3, GaN, AlN, diamond) have certain outstanding physical properties which make these materials so attractive for power electronic, optoelectronic and rf applications. However, the growth of bulk crystals with large diameters and with high quality and yield and the manufacturing of substrates from these crystals are much more complicated in comparsion to the very mature materials Si and GaAs.
In the presentation the difficulties in growing bulk and epitaxial WBG semiconductors will be introduced and technical solutions will be shown which have been developed to overcome the existing obstacles. Special focus is put on SiC, GaN and AlN. The status of these materials is compared in terms of avaible crystal size, totally produced wafer area and typical crystal defects.
An outlook will be given to the next scientific and technological steps which must be solved in order to accelerate the commercialization of the materials further.

Biography
Dr.-Ing. Jochen Friedrich studied Materials Science at the Friedrich-Alexander University of Erlangen-Nuremberg (FAU), Germany. After receiving his Dr.-Ing. degree from the FAU in 1996 he joined the Fraunhofer Institute of Integrated Systems and Device Technology (IISB). Since 2004 he is head of the Department Materials at IISB which was formerly named Crystal Growth. Together with his colleagues Dr. Jochen Friedrich received several awards: “Wissenschaftspreis des Stifterverbandes für die Deutsche Wissenschaft 2003”, Award of the „Gesellschaft für Mikroelektronik, Mikro- und Feinwerktechnik (GMM) des VDI/VDE“ 2005, Best Lecture Award of the International Workshop on Crystal Growth Technology 2008, Microelectronics Innovation Award 2009, and EMRS-Symposium W Best Poster Award 2016. He was also president of the German Crystal Growth Association (DGKK) from 2012 to 2016. His department is doing applied research for its industrial partners on bulk growth and epitaxy of semiconductor materials (Si, Ge, GaAs, InP, SiC, GaN, AlN).