Highlights from the 2021 EUVL Supplier Showcase

Vivek Bakshi, EUV Litho, Inc., September 12, 2021

The continued success of EUVL in fabs depends on the products produced by EUVL infrastructure suppliers and services offered by nonprofit organizations around the world. There are many products and services that are important – some are well established, and some are new to the EUVL area.

EUV Litho started a new workshop, "EUVL Supplier Showcase," where suppliers and nonprofit organizations can talk about their products and services for EUVL infrastructure. Now in its second year, this new forum has been a success. In this blog, I will share highlights from this year's showcase, which was held online on August 16-17, 2021.

- **Keynote** - Debbie Gustafson of Energetiq delivered the keynote. She described how Energetiq has built itself as a successful company in the EUVL infrastructure area. She attributed customer knowledge and support, agility, and adaptable technology to as the key to success for Energetiq.

- **Technical Tutorial** - Philipp Naujok of optiXfab gave a tutorial on "The art of fabricating high reflective multilayer coatings." OptiXfab, in addition to Energetiq, has been a success story for EUVL infrastructure suppliers. Philipp gave a tutorial on how to manufacture multilayer mirrors that propagate EUV and soft X-ray photons, explained why ideal and practical performances of mirrors differ, and discussed how their company is improving the performance of multilayers.

- **Supplier Presentations**
    - Christopher Metting (Accustrata) described their capability for next generation quality monitoring and process control. Their technology allows in situ monitoring and control of composition of compound materials, alloys, and film quality during thin film manufacturing.
    - Warren Montgomery (Irresistible Materials) described how their multi-trigger resist (MTR) can plug into an existing environment using an organic resist process without increasing cost of ownership while still delivering etch resistance, photo speed, and resolution benefits over other organic photoresist systems.
    - Sung Park (Molecular Vista) described his new instrumentation – Infrared Photo-induced Force Microscopy (IR PiFM) – that can deliver molecular composition information in addition to regular AFM data. This technique is being evaluated for applications in EUVL and looks very promising.
    - Peter Oberta (Rigaku Innovative Technologies Europe s.r.o.) described their EUV metrology and detectors. His company is known for their replicated grazing incidence optics in EUV and soft X-ray applications. Their EUV detectors have recently gained popularity.

- Slava Medvedev (ISTEQ) described his high-brightness LPP based source to support EUVL metrology for mask inspection. They have impressive test data and I look forward to data from the field on the performance of their sources.
- Marcel Demmler (Scia Systems) described their specialized equipment for EUV applications in the area of ion-beam figuring, reactive ion-beam etching, multilayer coating, and dry cleaning of surfaces.
- Meng Lee (Veeco) presented ion-beam technology tools which are being used by all current EUV mask blank suppliers to produce EUV mask blanks. He also presented how their tools will play part in the depositions of the new mask absorber materials.
- Supriya Jaiswal (Astrileux) presented new technology from her company that promises a better uniformity and defect tolerance compared to the current state of-the-art technology and increased throughput for EUV masks.
- Matthew Harada (K&M Labs) presented EUV sources, based on high order harmonic generation (HHG). In addition to metrology, these sources are now being used by IMEC for interference lithography for resist evaluations.
- Yusuke Suzuki (Dai Nippon Printing Co., LTD) presented their EUV mask production capabilities, which are now enabled by multi-beam mask writers(MBMW), to produce 1.5 nm position accuracy.
- Sung Won Choi (FST) shared info on their EUV infrastructure tools for EUV pellicles: mounter & demounter, inspection system, and transmittance & reflectance measurement system. They also now have EUV pod inspection systems.

- **Nonprofits Organizations supporting EUVL Infrastructure**

  - Satinder Sharma, professor at IIT Mandi, presented information on photoresists technology developed for semiconductor industries at IIT Mandi. They have an Advanced Photo Resist Formulation Facility (APRFF) and Advanced Photo Resist Formulation Facility (APRFF) to assist in the development.
  - Sangsul Lee of Pohang Accelerator Laboratory presented information on how they serve EUVL development. They have an existing facility to support semiconductor R&D and they are building an EUV storage ring and test infrastructure to support chip makers, tool manufacturers, and universities.
  - Ryan Miyakawa (CXRO) described facilities and services which have been serving the community from the very beginning of EUVL development. As EUV heads toward high NA, CXRO is ready to help the industry with the new challenges ahead in the areas of mask 3D effects, novel absorbers, absorber metrology, and lots more.
  - Norbert Koster (TNO) presented an overview of their plasma and reticle exposure facility and extensive metrology infrastructure that are actively involved in supporting EUVL development.
  - Jochen Vieker (Fraunhofer) detailed their standalone EUV sources that are enabling EUVL interference lithography, broadband EUV reflectometry, EUV spectrometry, and EUV irradiation tools for accelerated lifetime testing of critical components.
  - Charles Tarrio (NIST) presented their facility that has been one of the pioneer facilities for development of EUVL. He described their facility's ability to support work on optics characterization, optics contamination, detector characterization, and out-of-band radiation.

- Iacopo Mochi (PSI) shared that they have facilities for EUV interference lithography (XIL) and lensless EUV microscopy (RESCAN) under the laboratory for micro and nanotechnology. He also provided details on how to access the facility and submit proposals for access.
- Michael Kolbe (PTB) described his metrology light source (MLS) at PTB. Their facility is frequently used by tool makers for source and detector calibration, EUV reflectometry, and scatterometry. They have brand new instrumentation ready to start operation in January 2022: a lubricant-free big reflectometer for samples even as large as HVM source collector mirrors and can accommodate samples up to 150 kilograms for measurements.

We want to thank EUV-IUCC, Irresistible Materials, and optiXfab for sponsoring this event. The workshop proceedings are now available on our website and contain PDF presentations as well as a video recording of the meeting on the Zoom platform.

We look forward to our next Supplier Showcase and hope that you will join us for the upcoming 2021 Source Workshop. The Source Workshop will provide a look into the latest R&D related topics for photon sources for EUVL and metrology. We have several industry leaders planning to give keynote presentations and have an impressive lineup of speakers and short courses.