MEDEA+ forum outlines Europe's EUV progress

A recent invitation-only event hosted by European cooperative microelectronics R&D program MEDEA+ in Barcelona, Spain, in mid-November offered insights into progress in extreme-ultraviolet (EUV) lithography, as efforts continue to push the technology toward use in volume chipmaking processes.

A complete EUV exposure tool will be available in 1Q06 as an alpha tool—one shipped to IMEC in Leuven, Belgium, and another to Sematech at Albany, NY—but it is not quite ready for use in production. Its development started as a MEDEA project in 2001 and includes work by Carl Zeiss, Oberkochen, Germany, on complex de-magnifying optics. Zeiss has developed 13.5nm optics with a numerical aperture of 0.25, capable of 50nm resolution, a 26 × 33 mm field, and a 4× de-magnification.

Rob Hartmann, marketing manager, ASML, said EUV power of 800W over 2-Pi steradians has been achieved at 4kHz, an increase of three orders of magnitude over three years, so power is no longer a major issue. However, he admitted that collector lifetimes, masks, and resists are still major problems; other remaining critical issues include optics quality and life and reticle protection during storage, handling, and use.

Another MEDEA+ project on EUV led to the development of reticles for EUV lithography systems. They can be fabricated in the AMTC (Advanced Mask Technology Center) in Dresden and are available now. Two other MEDEA+ projects are developing maskless lithography using different principles, but neither is available, and the concept has yet to be proved.

A rapid thermal annealing (RTA) system developed under MEDEA+ can be used at up to 1100°C with heating rates of up to 900°C/sec. This 'Levitor' machine, and a simpler one for use at up to 400°C, is available now from ASMI for annealing silicon after ion implantation, and for the silidization of conducting layers. The heat is supplied by conduction rather than by radiation, with the wafers precisely located between two SiC coated graphite blocks in a stream of hot gas emerging from jets to ensure uniform heating. Power consumption is 6-20kW, whereas tungsten filament RTA consumes 200-250kW. It has been qualified for 65nm, with qualification for 45nm now commencing.

About 2000 person-years have been invested in four MEDEA+ projects on EUV lithography since 2001, according to Peter Tischer, MEDEA+ chairman of technologies, but it's unclear how much money the group has invested to bring EUVL to market—funds for the projects come from participating companies' own countries, with no apparent central budget. However, personnel costs alone likely approach an eye-popping $200 million, figuring $80,000-$100,000/year for each person-year contributed to the EUVL programs.

Tischer noted some MEDEA+ project results have not worked out as anticipated—for example, 157nm lithography was intended to be used only for the 45nm technology generation, so it was displaced by immersion lithography. Another project has resulted in a process to fabricate automotive devices for 42V systems, but the automotive industry has decided it does not want to move to 42V in the near future.

Set up in 2001 and slated to run until 2008, MEDEA+ was conceived to ensure European continued technological and industrial competitiveness. Discussions are planned this year with public authorities to determine interest in a successor program. MEDEA+ chairman Arthur van der Poel said the project's 11 board-member companies represent 13% of the overall R&D expenditure of Europe's top 500 companies (ranked by amount of R&D investment), with an annual investment of over €13 billion ($15.25 billion) and a combined R&D/sales ratio of >11%. — *Brian Dance, European Contributing Editor*