193nm Immersion litho on track for 45nm half pitch

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Demonstrating significant progress in all aspects of the technology, 193nm immersion lithography is on track for insertion into volume manufacturing, with good prospects for extendibility to subsequent generations, concluded industry experts at the 2nd International Symposium on Immersion Lithography, held from 12 to 15 September 2005.

"With more than 380 lithographers attending the 2nd International Symposium on Immersion Lithography, broad support to develop immersion lithography was clearly shown," said Kurt Ronse, general chair of the Symposium and Lithography Department Director at IMEC. "This strong drive has resulted in significant progress on all critical issues and a general acceptance that immersion lithography will be a key technology for 65nm and 45nm half pitch critical layer printing."

The latest timelines of the immersion scanner suppliers remain unchanged. Understanding of resist and top coat interaction mechanisms with water is clearly under way and continuous improvements have been reported. Defectivity is still a major issue and will remain so. However, considerable progress has been achieved compared to last year's Symposium with significant understanding of the immersion defect generation mechanisms. Process defects are being widely explored now. First solutions are in preparation which proves that immersion is on its way.

Other findings of the Symposium, reported in numerous presentations,

included the following:
- Tools in the field with NA - Hyper NA scanners (NA > 1) are taking full advantage of immersion and are in preparation. They will reach the market within the coming year. Mask polarization effects have been shown to be manageable, and full polarization control of the illuminator has been described.
- For very high NA (> 1.3) initial studies on liquids and optical materials have been started resulting in some candidate high index fluids which indicate the feasibility of extending immersion beyond water and 45nm half pitch.

At the conclusion, the Symposium steering committee identified that immersion lithography is now widely considered as the coming litho technology. It is firmly on track for 65nm half pitch insertion into volume manufacturing and extension to 45nm half pitch. Based on the progress reported the list of critical immersion issues was updated to:
1. development of high index fluids to replace water;
2. development of high index lens materials;
3. resist development in terms of leaching, line edge roughness, refractive index;
4. development of solutions to further reduce immersion defectivity;
5. double exposure demonstration;
6. lens design including polarization control at NA >>1;
7. development of mask infrastructure to minimize polarization effects.

The Symposium, held September 12-15 in Bruges, Belgium, was organized by IMEC and SEMATECH in cooperation with Selete. The next worldwide 193nm immersion forum - the 3rd International Symposium on Immersion Lithography - will be held in Japan in September-October 2006.

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