Lithography Performances of 248nm and 193nm Scanners in Production Mode

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To enable geometry shrinks, new type of tools is mandatory. Semiconductor manufacturers need to balance the cost of product shrinks with the economic value associated with such shrinks. As lithography is a key parameter for these shrinks and tools become more and more expensive, it is necessary, in order to better control costs, to know the real limits of all types of lithography tools before engaging so high investments.

During this presentation we will show achieved performances of different scanners used in ATMEL Fabs. We will explain how to test the ultimate resolution of 248nm scanners with 0.7 and 0.8 Numerical Aperture (NA) and 193nm scanners with 0.85 NA, in production mode (patterning and overlay).

With feed forward overlay correction system, the mix and match of different tools is not any more an issue, the overlay performance of different scanners can allow a 30nm overlay performance in production mode. Overlay performances obtained with different scanners will be presented.

By using different Resolution Enhancement Techniques (RET), such as Optical Proximity Correction, Attenuated Phase Shift Mask, Resist Etch Trimming and Hard Mask, process window for 0.7 and 0.8 NA 248nm scanners is significantly improved. Presented data will focus on lines and spaces for both Flash and CMOS processes. Also, we will present the limitation of the contact process and the need of 193nm scanners for this type of patterning. Finally, we will show contact performances on 0.85 NA 193nm scanners.

Moving to new generation scanners is a major investment. Our goal is to use each scanner generation up to its limit, with the introduction of innovating processes. However, when necessary, new tools need to be fully compatible with old ones and useful for at least two technology nodes.
Reticule cost may become a big issue for low and medium volume products. High NA 0.85 dry 193nm scanners need to be able to print, with an acceptable process window, the 65nm Flash process and a large number of layers for the 45nm technology node.