

## IS EUV LITHOGRAPHY DESTINED TO BE ALWAYS FOR THE “NEXT GENERATION”?

Daniel Henry

ST Crolles 2 Alliance

Advanced patterning program manager

As with many other developing technologies, the history of lithography is full of developments that have never come to fruition such as X-ray and ion beam projection. as well as the last development of 157 nm. Is EUV lithography (EUVL) in the same situation?

Compared to the original target: the introduction of EUVL for the 70-50nm nodes in 2007, EUVL is now being projected for the 32 nm in 2009 at best guess. Why such a shift?

First the current 193 nm DUV technology is being extended far beyond its initial projections (NA : 0.93 ). More over the recent development of 193 nm immersion with the potential of “hyper-NA” (NA >1.5) optics, combined with a continuous reduction of K1 (<0.3) will allow imaging of features with pitches close to 70 nm.

This immersion solution capitalizes on most of the development of 193 nm exposure tools and supporting infrastructure. Also, the next generation of scanners with <10 nm, 3 sigma overlay performance will allow a double exposure strategy that might extend the 193 nm immersion down to the 22 nm node.

In the same time EUVL has encountered significant delays and the shift in the original target has induced dramatic increases of the technical requirements. Toolmakers now must gain at least an order of magnitude in EUV power in order to achieve throughputs of 120 wafers per hour, while the blank (reticle substrate) manufacturers must reduce the multi-layer substrate defectivity by two orders of magnitude. This increased technology complexity may translate into a cost of \$50M for a EUVL tool. This has resulted in a lack of user commitment that may further discourage toolmakers’ investment and weaken their potential Return on Investment.

However, some companies like Intel are still promoting an aggressive schedule for EUVL to be ready for manufacturing in 2009 at the 32nm node and beyond. Those companies are involved in high volume manufacturing with limited number of mask sets such as DRAM, so EUVL may present a viable cost of ownership solution. This may not be the case for diverse production such as ASIC or foundries. and some lithographers publicly state that EUVL will never happen due to technical difficulties, emergence of alternative solutions, and economic concerns.

Finally, yes, optical lithography will continue to advance to even smaller geometries such as 22 nm, but forecasting the technology that will make this possible is the dilemma.