1. Title:	Defect Mitigation and Reduction in EUVL Mask Blanks
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3. Abstract body:

The availability of defect-free mask blanks is one of the most significant challenges facing the commercialization of extreme ultraviolet lithography (EUVL). The lowest total defect density achieved for champion mask blanks is 0.09 def/cm2 for defects > 70 nm (polystyrene latex equivalent size)1. By total defect density, we mean the defect density of the entire mask blank substrate plus the Mo/Si reflective coating. Despite significant advances in our ability to clean substrates, the incoming substrate contributes more defects than the coating process to the total number of defects on the champion mask blanks. This is because cleaning processes are ineffective against substrate pits, which dominate the substrate defect distribution after cleaning. Fortunately, defect mitigation methods have been developed to planarize substrate pit and particle defects. We have designed and installed a new process module specifically for planarizing substrate pits and particles. This process module has a number of new features, such as the ability to isolate the etch source during the deposition steps, and should enable the planarization process to be done more cleanly than what has been done before. We have successfully used the coat-and-etch planarization process developed at Lawrence Livermore Lab and will show initial results for the smoothing of pits and particles; we currently can render ~50 nm high particles non-critical and are on track to do the same with ~20 nm deep pits by the time of the symposium. Currently, the greatest challenge for us is to demonstrate that this planarization process can be clean enough for manufacturing. We shall present our first results on the particles added during the planarization process and the composition of these particles, which is critical to identifying their origin and eliminating them.

In addition, we shall also highlight recent progress in our defect reduction effort, which is primarily focused on eliminating defects that might occur during processing.

1 R. Randive et al., International EUVL Symposium, San Diego, CA., Nov. 2005.

Keywords: Ion beam sputtering, Mo/Si, mask, extreme ultraviolet lithography, nano-particle analysis, defect density

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