An *In situ* Analysis of EUV Resist Film Inhomogeneity during the Dissolution Process

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The resist dissolution process plays an important role in the resist's optimization for next generation lithography. In previous papers[1,2], the authors have proposed the use of in-liquid high speed atomic force microscopy (HS-AFM) for analyzing resist dissolution *in situ*. With this method, a visual appreciation of the dissolution process, based on a 32nm isolated line pattern lithographically exposed by an extreme ultraviolet (EUV) exposure tool, was achieved.

To review, early work using this method showed a difference in the dissolution characteristics, in terms of resist film swelling characteristics and dissolution 'grain' size, for commonly available EUV resists depending on resist platform/chemical composition and developer solution utilized[3]. With these results, further experiments using a number of model-resist platforms at ultrathin film thicknesses were performed. Obtained results provided new insights in the definition of resist dissolution mechanisms in the form of dissolution 'clusters' and their decrease in size at these film thicknesses regardless of resist platform[4].

In this paper, utilizing the fundamental knowledge and analysis methods acquired in previous works, an initial investigation on the existence/possible effect of resist film inhomogeneity on resist lithographic performance, especially on line width roughness (LWR) which is considered a major concern for EUV resists, is discussed. This was done through an *in situ* analysis of the variation of film surface roughness at the exposed area before and during dissolution.

Detailed results on the correlation of resist film inhomogeneity and lithographic performance at various resist platforms will be reported during the conference.

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1 T. Itani and J.J. Santillan, Appl. Phys. Express 3, 061601 (2010).
2 T. Itani and J. J. Santillan, Proc. SPIE 7972, 79720H (2011).
3 T. Itani and J.J. Santillan, J. Photopolym. Sci. Technol., 23, 639 (2010).
4 T. Itani and J.J. Santillan, *submitted to* Jpn. J. Appl. Phys (*presented at* MNC2011).