Novel nanoparticle photoresists development for EUV lithography

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Extreme ultraviolet (EUV) lithography is a leading candidate for next generation lithography because it enables ongoing scaling of semiconductor devices. Over the last few years, EUV exposure tools and materials have made remarkable progress and manufacturing of semiconductor devices by EUV lithography is expected to occur shortly. In order to maximize EUV lithography benefit, significant improvement of resolution and sensitivity is required for EUV resists.

We have already reported zirconium and hafnium oxide photoresists but some papers pointed out that EUV absorption of these metal species is low[1]. This has led us to develop new metal oxide photoresists and resulting micro-scale patterning images are shown in Figure 1. We have developed metal oxide photoresists having Ti, Zn, In and Sn metals other than Zr and Hf and they readily form micro-scale patterns at exposures of of 248nm wavelength with 150mJ/cm^2 exposure dose.

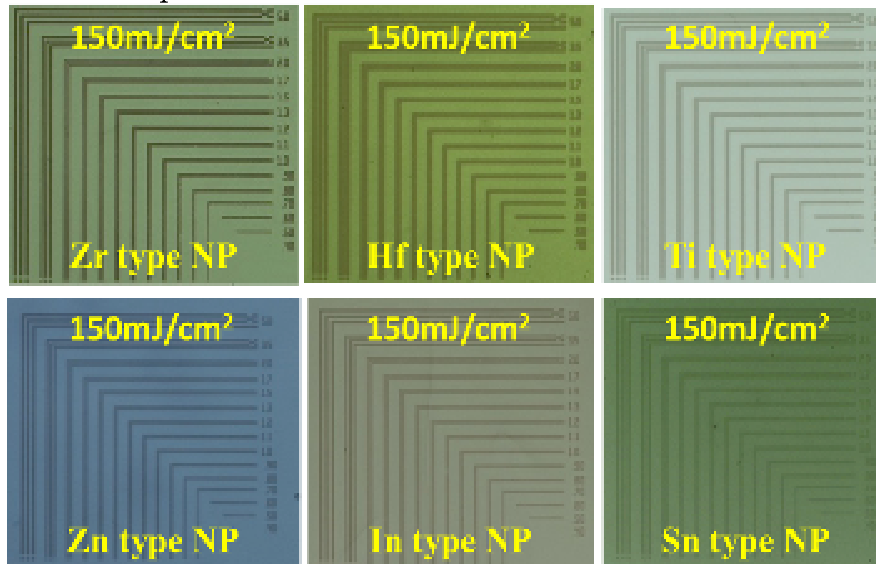

Figure 1 Micro-scale patterning result

We have evaluated some new metal oxide photoresists with EUV light at Lawrence Berkley National Laboratory (LBNL) and 18nmLS and 16nmLS were patterned with 124mJ/ cm^2 exposure dose.

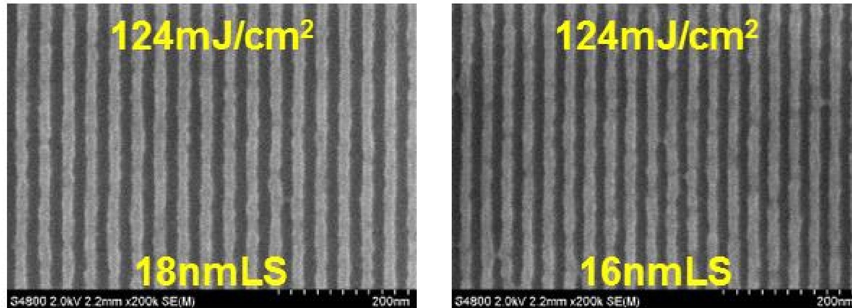

Figure 2 EUV exposure result with new metal oxide photoresist

In this paper, we will report recent progress in resolution and sensitivity improvement of our metal oxide nanoparticle photoresists.

[1] Henke, B. L.; Gullikson, E. M.; Davis, J. C. *At. Data Nucl. Data Tables*, **1993**, *54*, 181.