Metal oxide cluster compound photoresists for EUV lithography

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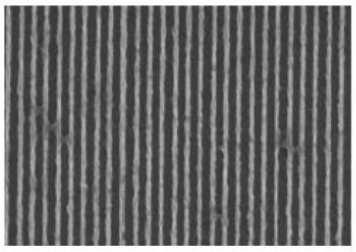
EUV lithography has become a leading candidate for next generation lithography. The main challenge for EUV resists is to satisfy resolution, line-width roughness (LWR) and sensitivity requirements according to achieve the goals of the ITRS roadmap. The performance targets require development of entirely new resist platforms. Cornell University has studied metal oxide nanoparticle photoresists for this application. Zirconium oxide nanoparticles with PAG enabling sub 30nm line negative tone patterns at an EUV dose below 5 mJ/cm^2, show one of the best EUV sensitivity results ever reported. In this paper, recent progress in nanoparticle photoresists involving new metal cores will be described. Discussion regarding improved mechanistic studies will be included.

Related to new metal cluster studies, new metal elements have been incorporated into MOF-like resist systems to improve EUV absorbance for better lithography performance. In particular new zinc oxide units have shown better resolution than zirconium oxide nanoparticles. E-beam and EUV exposure results of these new photoresist will be described.

In a study of the patterning mechanism, (1) ligand exchange, (2) ligand dissociation and (3) condensation reactions are all considered to occur in parallel. However, these aspects of the mechanisms were investigated in experiments using DUV exposure. Improved mechanistic understanding derived from e-beam and EUV exposures will be discussed.



CD=26nmL, 4.2 mJ/cm^2

Figure 1. Extremely High EUV sensitivity using Cornell University's nanoparticle photoresist