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Advanced i-line resist performance with and without phase-shift masks

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ABSTRACT

The performance of the i-line AZ Spectralith resist under typical working conditions is examined. A study of primary lens aberrations including spherical aberration, coma, and astigmatism is presented for a lines and spaces reticle with and without phase-shift masks. The shapes and widths of isolated lines with varying parameters are studied. A comparison of simulated line widths with experimentally available AZ Spectralith resist line widths is made. The exact Kirchoff diffraction integral is used avoiding the paraxial approximation and taking into account 5 $\times$ magnification. The numerical apertures used are 0.40 for the ASM PAS 2500/40 stepper with partial coherence of 0.54, and 0.52 NA with 0.50 partial coherence for the canon 2000i. The aerial image is projected onto AZ Spectralith resist over a silicon oxide layer (0.28 μ m) on a silicon substrate, as well as resist on silicon. The 3-D simulation package includes the vector Maxwell equations, reaction-diffusion equations, and a Hamilton- Jacobi-based rigorous dissolution algorithm. Exposure process latitude is given for lines and spaces of 0.4 - 0.7 μm linewidths.