

Suitability of high numerical aperture i-line steppers with oblique illumination for linewidth control in 0.35 μ m complex circuit patterns

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ABSTRACT

A 2-dimensional scalar aerial image model was used to computationally study i-line imaging with oblique illumination. Limited comparisons between developed photoresist images and aerial images were made. The effects on CD control, exposure latitude, and bias, of varying annular and quadrupole geometry were mapped via simulation. Significant improvements in DOF of isolated lines was achieved with oblique illumination. Isolated line to dense line bias could be adjusted by changing the illumination type. Although oblique illumination improved the aerial image contrast at defocus, it caused degradation in the aerial image contrast at best focus. Long and short range proximity effects degraded the simulated CD control of optimized oblique illumination systems. This was observed in simulations of an SRAM gate cell. The imaging performance at .9 μ m defocus, of an i-line system (NA .48) with oblique illumination, was judged to be worse than a KrF system (NA .42) with standard illumination. Quadrupole illumination was not found to measurably affect lens distortion.