

Halftone Phase Shift Mask Blank, Halftone Phase Shift Mask,
and Pattern Exposure Method

ABSTRACT

In a halftone phase shift mask blank comprising a transparent substrate and a halftone phase shift film thereon, the halftone phase shift film is composed of a silicon base material consisting of silicon, nitrogen and 0-6 at% of oxygen, has a refractive index n of at least 2.4, an extinction coefficient k of 0.4-0.7, and a thickness of 40-67 nm. The halftone phase shift film is thin enough to be advantageous for photomask pattern formation, has chemical resistance against chemical cleaning, and maintains a necessary phase shift for phase shift function and a necessary transmittance for halftone function.

Figure 1A