Potential of phase shifted optical proximity correction for 65nm T joint pattern in high NA lithography

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A capable optical proximity correction (OPC) model and phase shift mask (PSM) to meet the requirement of low k1 lithography with the tight dimension control are urgently. However there is a phase confliction in imaging T joint pattern when phase shift mask is used. 65nm T joint pattern is usually imaged with line end shortening and it couldn’t be corrected well with mere OPC. New resolution enhancement technology named phase shifted optical proximity correction (PSOPC) is presented in this paper. A PSOPC mask with phase shifted serif modifies both the intensity and the phase of the local incident light simultaneously. The line end shortening pattern was corrected by PSOPC without phase confliction for T joint pattern. PSOPC can provide a better image fidelity and process robustness that could not be realized by introducing traditional OPC or PSM individually or integrating them simply for 65 nm T joint pattern. The results are simulated by Prolith and show that PSOPC as a new RET has much potential for 65nm T joint pattern lithography.

Key words: Lithography simulation, Prolith, Resolution enhancement technology, PSOPC, High NA

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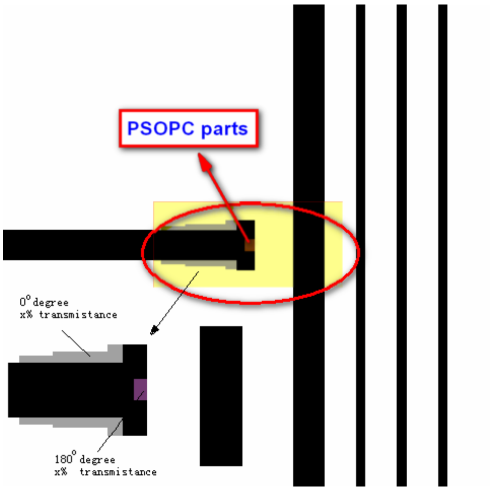

FIG.1. Mask with PSOPC

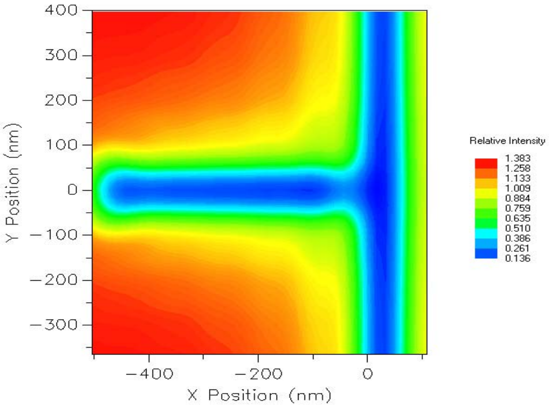

FIG.2. Resist T joint pattern with PSOPC

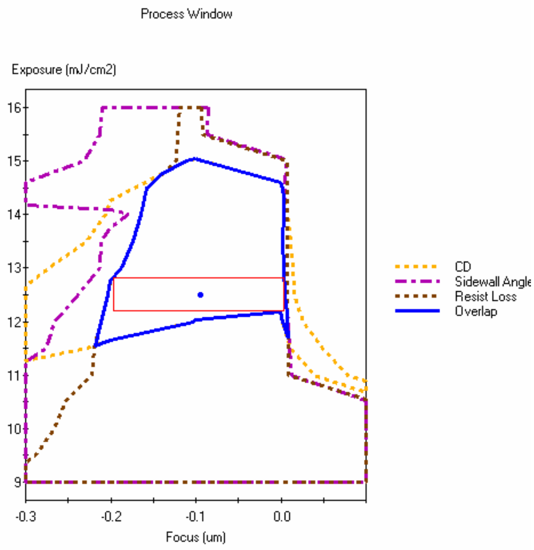

FIG.3. Process window (@5%EL)

$\lambda = 193.368nm$

$NA = 0.95(water\ immersion)$

$\sigma = 0.60/0.22$(Annular Illumination)

Resist : ArF JSR AR165J, thickness=200nm

BARC: Shipley AR19 ,thickness=48 nm