

## Helium Ion Beam Lithography with High Patterning Fidelity

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### Abstract

Different from optical projection lithography, maskless lithography generally uses a particle beam for resist exposure. Electron beam lithography has negligible wave diffraction, theoretically higher resolution and less equipment complexity. However, the electron scattering effects in resist and substrate can induce an undesired influence on the adjacent regions and thus lead to adverse effects in resolution, particularly when dense features with high patterning fidelity are needed. Proximity effect correction has been proposed to achieve feature size control by modulating the dose or beam shape. Nevertheless, it can still encounter resolution difficulties at advanced technology nodes. Helium ion beam lithography equips with an even smaller focusing spot and scattering range, and thus potentially even higher resolution and patterning fidelity. Patterns of 10 nm half pitch has been demonstrated, but further scaling encountered substantial obstacles. Therefore, proximity effect correction shall also be applied to compensate for the deteriorating effects. In this work, a simulation-based proximity effect correction method is proposed, and its effectiveness is investigated.