DOSE ASSIGNMENT IN ELECTRON BEAM LITHOGRAPHY.

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Introduction
One of the challenges that hamper the resolution of the Electron Beam Lithography is the Proximity Effect occurrence, which is experienced during the exposure of sample materials.

Proximity Effect
The two main types of interaction in the Proximity Effect are: Forward scattering (small angle) and Back scattering (large angle) [1].

Fig. 1a. Effect of Forward & Backward Scattering [2]. There are two types of Proximity Effect namely the Intra-Proximity Effect and the Inter-Proximity Effect.

Fig. 1b. An Illustration of both the Inter-Proximity Effect and Intra-Proximity Effect [2]

The following are methods of compensating for Proximity Effect viz.: Dose modification, Shape modification, Equalization of background dose correction (GHOST) and Multilayer resist technique, [1],[3] [4].

Experimental Methods
This experiment was carried out on the three categories on the substrate: NO Proximity Effect Correction (NO PEC), OLD Proximity Effect Correction (OLD PEC) and New Proximity Effect Correction (NEW PEC).

The NO PEC has no Point Spread Function (PSF), the OLD PEC contains the PSF generated through the Monte Carlo Simulation, while the NEW PEC contains the PSF generated through the Modern Version of the Monte Carlo Simulation.

For the Vector Beam 6 (VB6) Electron Beam Tool to write on a substrate, it passes through the processes in Fig. 2., as each process plays a vital role in the effectiveness of the desired pattern.

Result & Discussion
The NO PEC reviews the variations of line widths, line edge roughness, Intra-Proximity Effect and the dosage assigned is unevenly distributed. The OLD and NEW PEC, both compensated for the Proximity Effect as there is uniformity in the allocation of dose for pattern fracturing and improvement in the line edge roughness.

References