Nounu, Hatem, "Mask Development for Nano-Scale Atom Beam Lithography"

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Lithography, the process of transferring the image of a master pattern into a polymeric resist, has provided the foundation for advances in integrated circuit technology for the past half-century; soon, it will enable chips with over 2.5 billion transistors. Atom beam lithography (ABL) is a proximity printing technique where a broad, collimated beam of energetic helium atoms floods a stencil mask and the transmitted beamlets transfer the mask pattern to resist on a substrate. This promising technique shares the extremely small diffraction and resist scattering of light ions, yet is immune to the charging artifacts and line edge roughness that plague charged particle lithography at the nanoscale. However, helium atoms implanted into the stencil mask are known to cause compressive stress and mask wrinkling after a few tens of exposures. In this dissertation, we describe the development of an ion absorbing coating that allowed us to use a silicon stencil mask for nanoscale ABL.