

MS Thesis Announcement

**OPTIMIZATION OF REACTIVE ION ETCHING TO FABRICATE
SILICON NITRIDE STENCIL MASKS IN SF₆ PLASMA**

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Place: Room No. E225

Time: 10 am

Committee Chair: Dr. Paul Ruchhoeft

Committee Members:

Dr. Dmitri Litvinov

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Stencil masks are used to print ultra-high resolution patterns using helium ion/atom beam lithography and are often manufactured from thin, free-standing silicon nitride membranes. The masks have sub-200nm openings etched through the thickness of the membrane using a reactive ion etch (RIE) process that determine the printed pattern. This project deals with the optimization of a sulfur hexafluoride and oxygen RIE. In this process, 0.5 μ m thick silicon nitride membranes are coated with 20nm of copper (hard mask) and 200nm of poly (methyl methacrylate) (resist). The desired patterns are then formed in the resist by electron beam lithography, and the patterns are transferred through copper by argon milling. A mixture of 0.8 millitorr of sulfur hexafluoride and 0.2 millitorr of oxygen RIE step at a power of 15 watts then transfers them through the thickness of the membrane. The process allows for the patterning of extremely straight features (anisotropic etch), has excellent selectivity (200) between silicon nitride and copper, suffers from minimal RIE lag, and is generally very robust. The challenges associated with this process lie in etch non-uniformity due to membrane heating and pattern fidelity in the milling step. Solutions to these problems have been explored and stencil masks with sub-200 nm etched openings have been successfully fabricated.