Abstract Submitted
for the GEC16 Meeting of
The American Physical Society

Effects of Gas and Surface Temperatures during Cryogenic Etching of silicon with SF_6/O_2 STEFAN TINCK, ERIK NEYTS, University of Antwerp, THOMAS TILLOCHER, REMI DUSSART, Universite d'Orleans, ANNEMIE BOGAERTS, University of Antwerp, PLASMANT TEAM, GREMI TEAM — Cryogenic deep reactive ion etching (DRIE) of silicon and SiO2 used for creating vias is investigated. The wafer is cooled to about -100 C and a SF_6/O_2 mixture is applied. During cryogenic DRIE, a SiF_xO_y passivation layer is formed which prevents isotropic etching and the diffusion of F atoms into the Si or SiO2 material. When the wafer is brought back to room temperature, this passivation layer desorbs naturally, leaving a clean trench with no scalloping. The primary issue with cryogenic DRIE is the high sensitivity to oxygen content and substrate or gas temperature. Both effects are investigated here. We believe that understanding the temperature dependent surface behavior of the O and F atoms to etch silicon is a primary step in obtaining full insight in the mechanisms of the SiFxOy passivation layer formation and automatic desorption. For this purpose, we apply a self-consistent model that covers both the bulk plasma characteristics as well as the surface processes during etching. Molecular Dynamics (MD) simulations are also performed to obtain insight in the surface reaction mechanisms. For validation of the modeling results, the etch rates are also experimentally obtained with reflectometry and Scanning Electron Microscopy (SEM) pictures.

Stefan Tinck
University of Antwerp

Date submitted: 10 Jun 2016 Electronic form version 1.4