Abstract Submitted
for the GEC15 Meeting of
The American Physical Society

Cryogenic etching of Si with SF_6/O_2: a modeling and experimental study STEFAN TINCK, ERIK C. NEYTS, University of Antwerp, THOMAS TILLOCHER, REMI DUSSART, University of Orleans, ANNEMIE BOGAERTS, University of Antwerp, PLASMANT TEAM, GREMI TEAM — Cryogenic etching, although already proposed in 1988, has recently seen an immense increase in popularity in microchip development, due to its very promising ability to reduce plasma induced damage of ultra-small features. Here, we wish to obtain a fundamental understanding of the SF_6/O_2 plasma behavior and its interaction with the surface to improve cryogenic etching. We apply numerical models and experiments to describe the plasma behavior and plasma-surface interactions. SF_6/O_2 low-pressure plasmas are investigated at different wafer temperatures ranging between conventional 293 K and cryogenic 173 K. Cryogenic etch rates are slightly higher due to local cooling of the gas above the wafer, resulting in a slightly higher reactive neutral density. Fundamental surface reactions are also investigated with MD simulations. It is found that the probabilities for chemisorption (i.e., sticking) are insignificantly affected by the wafer temperature. However, surface diffusion and thermal desorption occur much slower at cryogenic conditions and, as a result, it is found that a thick layer of physisorbed species is formed during cryoetching, which is absent at room temperature etching, and which facilitates the formation of an oxygen-based passivation layer.

Stefan Tinck
University of Antwerp

Date submitted: 18 Jun 2015 Electronic form version 1.4