

Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Photochemical ablation of Polytetrafluoroethylene (PTFE) under 157-nm irradiation SHARON R. JOHN, STEVEN C. LANGFORD, J. THOMAS DICKINSON, Washington State University — We report time- and mass-resolved measurements on neutral molecular particles emitted from polytetrafluoroethylene during exposure to 157-nm laser radiation at fluences where relatively rapid etching is observed. By comparing the time-of-flight signals over a range of masses, we conclude that $(\text{CF}_2)_N$ fragments for $N=1-6$ are emitted directly from the surface in substantial quantities. In contrast, the monomer ($N=2$) is the principal product during irradiation at 248 nm, due to a thermal decomposition mechanism. The time-of-flight signals of all the $(\text{CF}_2)_N$ fragments show fast components with kinetic energies of ~ 0.6 eV, indicating a non-thermal mechanism. These high kinetic energies are consistent with photochemical scission of the polymer backbone, where a part of the excitation energy is delivered to the fragment as kinetic energy. Although clean etching is observed under these conditions, the great majority of the mass removed appears as much larger fragments with a size distribution of 10 nm to $1\mu\text{m}$. The time-of-flight signals also show a slow component. We present a collisional model to explain the slowing down of neutrals molecules created by photochemical scission. Intense electron, positive and negative ion emissions are also observed. Their formation and emission mechanism will be discussed.

Sharon R. John
Washington State University

Date submitted: 27 Nov 2007

Electronic form version 1.4