# Photon-induced Dissociation and Desorption Studies of $C_3F_8$ Adsorbed on Si(111)-7×7 by Using Core-level Photon-stimulated Desorption Spectroscopy

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We present an analysis of the photon-exposure dependence of the PSD positive-ion from $C_3F_8$ adsorbed on Si(111)-7×7 irradiated by monochromatic synchrotron radiation with photon energy near F(1s) core-level. The dosage of $C_3F_8$ molecules on the Si(111)-7×7 surface was $1.0\times10^{15}$ molecules/cm$^2$. The PSD data was collected using synchrotron radiation at NSRRC Wide-Range beam line. Fig. 1 shows the photon-exposure dependence of $F^+$ ion yields during 730 eV photon irradiation. The $F^+$ desorption signal was zero when irradiation started, and then increased with increasing photon exposure to a roughly constant maximum intensity. A kinetic model based on the ionization of F(1s) core-level was proposed for the explanation of the photolysis of the $C_3F_8$-dosed surface induced by this photon energy. Fig. 2 shows the photon-stimulated desorption spectrum of $F^+$ ions near the F (1s) edge at high exposure to 730 eV photons ($1.3\times10^{18}$ photons/cm$^2$) and near completion of reaction. In Fig. 2 two peaks at 687.0 and 689.4 eV and a threshold at ~ 685 eV were observed. The threshold in Fig. 2 is most likely related to the F(1s) (~685 eV) core-level binding energy, indicated by arrow in the figure. Such threshold behavior is indicative of a desorption mechanism involving Auger decay of F(1s) core-hole. The threshold at ~685 eV near F(1s) core-level can be assigned as due to an excitation of F(1s) core-level electron in a SiF species to the conduction band minimum (CBM). The peak at 687.0 eV is attributed to an electronic transition from F(1s) to an unoccupied orbital localized at Si-F bonding, and the peak at 689.4 eV is due to an transition from F(1s) to an unoccupied orbital localized at F atom.

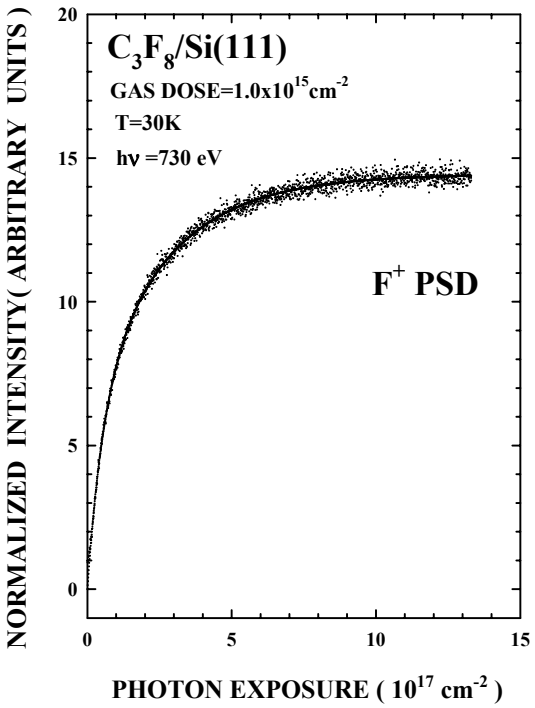


Figure 1. Photon-exposure dependence of the photon-stimulated desorption yield of $F^+$ ions from $C_3F_8$ adsorbed on Si(111)-7×7 surface at 30 K ($C_3F_8$ dose=$1.0\times10^{15}$ molecules/cm$^2$). The incident photon energy is 730 eV.

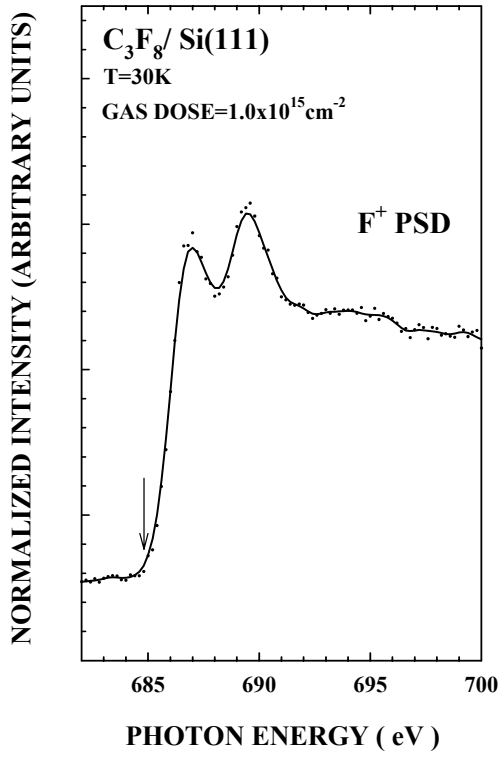


Figure 2. Photon-stimulated desorption spectrum of $F^+$ ions near the F(1s) edge for a $C_3F_8$/Si(111) surface (gas dose=$1.0\times10^{15}$ molecules/cm$^2$) at high exposure to 730 eV photons ($1.3\times10^{18}$ photons/cm$^2$) and near completion of reaction.