Effect of Ionization Laser Wavelength on the Detection of Iron Oxide Neutral Cluster Distribution in the Gas Phase

신동남*, 고동준, 양희정, 김병기, E. R. Bernstein[1]
포항산업과학연구원 환경연구팀; [1]Colorado State University
(jydnshin@rist.re.kr*)

Iron oxide (FemOn) neutral clusters are generated in the gas phase through laser ablation of the metal and reaction with various concentrations of O_2 in He. The mixture of He and neutral FemOn cluster species is expanded through a supersonic nozzle into a vacuum system, where the clusters are detected and identified in a time-of-flight mass spectrometer at 118 nm (10.5 eV), 193 nm (6.4 eV), or 355 nm (3.53 eV) photons. The cluster ion distribution, observed employing 193 nm laser ionization, is sensitive to the neutral cluster distribution as evidenced by the change in the observed time-of-flight mass spectra with changes in laser power, growth conditions and expansion conditions. With 118 nm radiation, the neutral clusters do not fragment because single photon absorption is sufficient to ionize all the clusters and the energy/pulse is ~ 1μJ. Comparison of the mass spectra obtained at 118 nm ionization (single photon) with those obtained at 193 nm and 355 nm ionization (through multiphoton processes), with regards to intensities and linewidths, leads to an understanding of the multiphoton neutral cluster fragmentation pathways losing one or two oxygen atoms.