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Photolysis of Mixed Ices with Synchrotron Radiation

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The photochemical and photophysical properties of mixed ices have received a substantial impetus in recent years. Astronomers have tried to conceive chemical synthesis of cometary-type ices or icy satellites of planetary systems in a laboratory. However, these species have extremely brief existences under typical condition and are difficult to prepare in sufficient numbers to allow detection. The matrix isolation technique has become recognized as an excellent method to store and to accumulate transient species, and has been successful in research on free radicals and other transient species. Taking the advantage of matrix isolation technique and the unique properties of synchrotron radiation (SR), we explored the photon-induced chemical reactions of mixed-iced analogs with exciting prospects. We used a cryostat/FTIR system coupled to SR to study the photo-products of mixed-ices samples. The VUV radiation was dispersed from a beam line of Taiwan light source. The end station consists of sample-preparation system, an ultrahigh cryogenic vacuum chamber, and an FTIR spectrometer. The cold target is maintained at 10 K in a closed-cycle refrigerator. In these experiments, the IR spectra of given icy samples are taken before and after VUV photon irradiation at the selected wavelength. Currently, our group is focusing on the studying of photochemistry for the icy systems of C2H2/NH3, O2/NH3, CO2/NH3, CH3OH/NH3, CO/O2/NH3, CO/CH3OH/NH3, H2O/C2H2/NH3, H2O/CO2/NH3, and H2O/CO/CH3OH/NH3. In this presentation, we report our experimental results on the spectral identification of IR absorption features produced through photon-induced chemical reactions in the C2H2/NH3, O2/NH3, and CO/O2/NH3 ices.