Synchrotron VUV Spectroscopies and Applications

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For the spectral investigations on diverse materials, the principal excitation light sources have been mercury lamps, xenon lamps, tungsten filaments, tungsten-halogen lamps, and various lasers in the visible and UV ranges. For these conventional and laser sources, to tune the energy to the vacuum-ultraviolet (VUV) region is difficult. Synchrotron radiation (SR) provides an intense and continuous source of VUV light. The high quality of VUV from SR gives the chances for scientists to investigate the spectroscopy and photochemistry of molecules and materials in this region. Using the VUV beam lines from the 1.5 GeV storage ring at National Synchrotron Radiation Research Center (NSRRC) in Taiwan, we are currently conducting the experiments of photoabsorption, photodissociation, photodesorption, photoionization, and photoluminescence researches applied to atmospheric, astroscience and electro-optic materials. Taking the advantage of synchrotron, we explore the VUV spectroscopies with exciting prospects. For investigation of VUV spectroscopy of the interstellar molecules, we have been measuring the absolute absorption cross sections at room temperature and jet-expanded temperature in the gaseous phase to assess the photochemically induced changes in planets. We also use a low temperature matrix-isolation technique coupled with IR or UV-visible absorption detection to study the spectroscopy of transient species and photochemistry of solid interstellar molecules and mixed-ice analogs. For the subjects of phosphors, wide-band gap electro-optic materials, and conducting polymers, we investigate their emissions excited with VUV light in relation to their structures, preparations, quantum efficiencies, and other process parameters. Some examples will be discussed in the presentation.

1. Yu-Jong Wu, Hui-Fen Chen, Sheng-Lung Chou, Meng-Yeh Lin, Hsiao-Chi Lu, Hong-Kai Chen, and Bing-Ming Cheng, "*Photolysis of Ethyne in Solid Neon and the Synthesis of Long-chain Carbon Clusters with VUV Light*", Astrophys. J. **721**, 856-863 (2010).
2. Bing-Ming Cheng, Hui-Fen Chen, Hsiao-Chi Lu, Hong-Kai Chen, M. S. Alam, Sheng-Lung Chou, and Meng-Yeh Lin, "*Absorption Cross Section of Gaseous Acetylene at 85 K in Wavelength Range 110-155 nm*", Astrophys. J. Suppl. Series. **196**, 3 (2011).
3. Hsiao-Chi Lu, Meng-Yeh Lin, Sheng-Lung Chou, Yu-Chiang Peng, Jen-Iu Lo, and Bing-Ming Cheng, "*Identification of Nitrogen Defects in Diamond with Photoluminescence Excited in the 160-240 nm Region*", Anal. Chem. **84**, 9596-9600 (2012).
4. Yu-Jong Wu, C. Y. Robert Wu, Sheng-Lung Chou, Meng-Yeh Lin, Hsiao-Chi Lu, Jen-Iu Lo, and Bing-Ming Cheng, "*Spectra and Photolysis of Pure Nitrogen and of Methane Dispersed in Solid Nitrogen with VUV Light*", Astrophys. J. **746**, 175 (11pp) (2012).
5. Ling Li, Lu Hua Li, Ying Chen, Xiujuan J. Dai, Peter R. Lamb, Bing-Ming Cheng, Meng-Yeh Lin, and Xiaowei liu, "*High Quality Boron Nitride Nanoribbons: Unzipping during Nanotube Synthesis*", Angew. Chem. Int. Ed. **125**, 4306-4310 (2013).
6. Sheng-Lung Chou, Jen-Iu Lo, Meng-Yeh Lin, Yu-Chiang Peng, Hsiao-Chi Lu, and Bing-Ming Cheng, "*Production of N_3 on Photolysis of Solid Nitrogen at 3 K with Synchrotron Radiation*", accepted by Angew. Chem. Int. Ed. (2013).