VUV and XUX Light Sources ◇

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In a recent research project incoherent vacuum ultraviolet light sources were developed for photoionization of organic analyte molecules in mass spectrometry [1,2,3]. Since some substances have an ionization potential above 10 eV our light source developent is extended to shorter wavelengths. The emission spectra of the light rare gases which emit at such short wavelength have been described in ref. [4]. In 2006 we have reactivated the experimental setup described in ref. [4] consisting of an ACTON VM506 VUV/XUV monochromator, an electron beam device, a gas system, and a detection system consisting of a sodium salicylate scintillator and a phototube. Studies concerning the emission of neon argon mixtures were performed. The first continuum of argon is emitted and bridges a gap between the Ar resonance line and the second continuum with its peak intensity at 126 nm, although with a rather weak intensity. VUV-optics has been developed to extract the short wavelength light from the source at about 1 bar working pressure and send it into the vacuum of a mass spectrometer. Tests with LiF windows have been performed in 2006 to avoid window-less versions which would require differential pumping. Transmission measurments near the cutoff of LiF windows had already been described in Ref. [4]. Here it is important to obtain the best transmission, possible. Since it is known that cooling of the sample improves the optical transmission near the cutoff, a sample holder has been designed and built which allows Peltier-cooling of 25 mm diameter windows by about 40 degrees. The effect of cooling on the optical transmission at 105 nm is visible with an increase in transmission by a factor of two, when cooling from room temperature to -17 °C. The effect of cooling at 106 nm, however, is minute. Reflective optics have been tested for light collection and refocusing from the source into the mass spectrometer. In 2006 only the geometry of the optical design has been tested using two relatively inexpensive parabolic mirrors with limited surface quality. They were, however, overcoated with an Al-MgF_2 layer for reflectivity in the longer wavelength VUV. The box coater described in ref. [5] was used for coating the mirrors.

References

[1] F. Mühlberger *et al.* Anal. Chem. **77** (2005) 7408
[2] F. Mühlberger *et al.* Anal. Chem. **77** (2005) 2218
[3] F. Mühlberger *et al.* Anal. Chem. **74** (2002) 3790
[4] A. Fedenev *et al.* J. Phys. **D37** (2004) 1586
[5] P. Maier-Komor *et al.* NIM A **438** (1999) 152

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