Photon-stimulated desorption mass spectroscopic system using a laser-produced plasma VUV emission source

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Photon-stimulated desorption processes of solid materials such as polymers have not well been understood. In contrast, simple molecules such as H_2, O_2, N_2 and CO have been investigated by using synchrotron radiation [1]. The facility is, however, usually large and in limited use. We have demonstrated a spectrally continuous vacuum ultraviolet (VUV) emission source in the wavelength between 115 and 200 nm using a laser-produced plasma (LPP) as a spectroscopic emission source [2]. Despite lower brightness and coherence compared with those of synchrotron radiation, the LPP emission source can be easily operated in a compact size in a small-scale laboratory. We, therefore, have proposed new photon-stimulated desorption surface mass spectroscopy using such broadband VUV emissions using the LPP. Adsorbed atoms or molecules on material surfaces should be desorbed and dissociated as a result of absorption of the wavelength-selected high-energy VUV photons. Material surfaces would be analyzed by detecting desorbed and dissociated atoms or molecules. This photon-stimulated desorption surface mass spectroscopy should have superior characteristics over conventional thermal desorption spectroscopy in terms of energy and spatial resolutions with minimum heat effect. This method is useful in the field of organic electronics.

In this paper, we report new photon-stimulated desorption mass spectroscopic system using the LPP. The irradiation wavelength dependence of mass spectra of polyvinyl chloride (PVC), polyvinylidene chloride (PVDC) and polymethyl methacrylate (PMMA) samples were demonstrated. We have found that the characteristic differences of the mass spectra were obtained in the wavelength shorter than 200 nm in each sample. Dissociation of atoms or molecules from material surfaces depended on bond energy or molecular structure.

References:
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