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The adsorption and photochemical studies of phenol/Ag(111)

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The adsorption and photoinduced processes of phenol adsorbed on Ag(111) have been studied by temperature programmed desorption (TPD). Phenol adsorbs and desorbs without thermal decomposition. TPD spectra show three peaks indicating a weak chemisorption layer, a buffer layer, and multilayers. Photoinduced O-H bond dissociation of phenol was found to occur mainly in the first monolayer and molecular hydrogen desorbed during UV irradiation. The photodissociation cross section was dependent on the coverage and the wavelength. A charge transfer photodissociation mechanism was proposed.

Two-photon photoemission spectroscopy (2PPE) has been employed to investigate the electronic states of phenol relevant to charge transfer photodissociation. On clean Ag(111) surface, the unoccupied image potential state between the Fermi and the vacuum level has been observed. A molecular resonance state was found when phenol adsorbed on Ag(111). Coverage dependent change of the phenol-induced feature has been investigated. From the photon energy dependence and the dispersion measurement, the coupling between the phenol-induced state and the image potential state was proposed. The affinity level discussed in photochemistry of phenol is thought to be responsible for the molecular resonance state in 2PPE experiment.