

X-Ray Photoelectron and Absorption Spectra of Fragments from NH₃/Cu(110) Induced by Soft X-Ray Irradiation

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We have studied fragments from NH₃ molecules adsorbed on Cu(110) induced by soft x-ray irradiation using x-ray photoelectron spectroscopy (XPS) and x-ray absorption spectroscopy (XAS) in combination with theoretical calculations. The soft x-ray induced dissociation of NH₃ adsorbed on Cu(110) leads to desorption of H⁺ ions and H⁰ neutral atoms leaving the NH_x fragments on the surface. Characterization of the NH_x is significant for understanding the dominant dissociation process by soft x-ray irradiation. The experiments were carried out on the surface end-station at undulator beam line I511 at MAX-lab. The analyzer chamber at the end-station is equipped with a spherical electron spectrometer (SCIENTA SES-200) for XPS and a partial electron yield detector for XAS. The Cu(110) crystal was cleaned by cycles of Argon ion sputtering and annealing to 800 K. NH₃ was adsorbed at 90 K and annealed to 140 K for 10 min to obtain only the chemisorbed NH₃.

In the N 1s photoelectron spectrum after soft x-ray irradiation, there are two peaks: the higher-energy peak is assigned to the chemisorbed NH₃ and the lower-energy peak arising from the irradiation is assigned to NH_x fragments. In the photoabsorption spectrum at the N K edge, the fine structure of the NH_x was also observed. We will present the assignment and the electronic structure of the NH_x based on the theoretical calculations.