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Initial adsorption process of NH_3 on the Si(111)7x7 surface

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The reaction of NH_3 on Si surfaces is crucial to the growth of various nitride films, which are important for a variety of electronic and optical devices.[1] Recently, NH_3 decomposition on the Si(111)7x7 surface was found to lead to a high quality 'epitaxial' Si_3N_4 films but its initial adsorption and decomposition mechanism is still unclear.[2] In this work, we extensively investigated the adsorption behavior of NH_3 on Si(111)7x7 by high resolution photoemission using undulator synchrotron radiation (BL-8A1, Pohang Accelerator Laboratory). Mostly from N 1*s* core level spectra, it was clearly found that (i) NH_3 initial adsorption is fully dissociative even down to 70 K and (ii) the initial dissociation lead not only to NH_2 but also to NH (about 20-30%). Furthermore, while the adsorption above about 200 K is saturated very early, the dissociation proceed up to a significantly higher coverage at a lower temperature. At such a high coverage and low temperature (below 120 K) case, the chemisorbed NH_3 molecules were also observed. This result manifests the unexpected complexity of the NH_3 adsorption behavior on Si(111)7x7, which is in clear contrast with the case of Si(100) and is not fully understood yet, especially for the low temperature regime.

[References]
1. J. W. Kim, H. W. Yeom, "Thermal decomposition of NH_3 on the Si(100) surface" Surface Science546, L820 (2003)
2. M. Björkqvist, M. Göthelid, T. M. Grehk, and U. O. Karlsson, "NH_3 on Si(111)7x7: Dissociation and surface reactions" Phys. Rev. B 57, 2327 (1998)