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Electronic structure investigation of a transition from two-dimensional gas to nanocluster array : Na on Si(111)7x7

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Electronic structure evolution along a two-dimensional gas-solid phase transition on Na/Si(111)7x7 was investigated by using photoemission spectroscopy. The gas-solid phase transition at room temperature was reported to be divided into three regions from scanning tunneling microscopy experiments; gas, nanocluster array, and breakup of nanocluster array.[1] At initial Na coverage, Na adsorbates were found to induce a surface state with a binding energy of 0.38 eV (S1). Further Na adsorption, up to 0.08 ML, shifts gradually the S1 state into the higher binding energy side by 0.2 eV. Above a critical Na coverage of 0.08 ML, new two surface states with binding energies of 0.46 (S2) and 1.14 eV (S3) develope. The S2 and S3 states keep the binding energies with variation of intensities at Na coverage between 0.08 and 0.22 ML. The gradual shift of the S1 state, at initial Na coverage, can not be explained enough only by static adsorption of Na atoms, which could be related to high mobility of Na atom within the 7x7 structure at room temperature. Moreover, the electronic transition at Na coverage of 0.08 ML is ascribed to a condensation into a nanocluster suggested by the previous scanning tunneling microscopy experiment.[1] The photoemission spectra identify interesting electronic structures of mobile Na atoms at initial Na coverage and a nanoculster array on Si(111)7x7.

[참고문헌]

1. Kehui Wu et. al, "Na Adsorption on the Si(111)-7x7 Surface: From Two-Dimensional Gas to Nanocluster Array", Phys. Rev. Lett. 91, 126101 (2003).