Molecular beam study of Chlorine adsorption at alkali covered Si(100) surface

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Research Contents

- Introduction -

The adsorption structure of Cl at Si(100) and influence of alkali metal to Cl adsorption at Si(100) has been investigated using a supersonic molecular beam technique, an auger electron spectroscopy (AES) and a quadrupole mass spectrometer (QMS).

- Results -

To obtain Cl uptake curve from which initial sticking probability (So) is evaluated at first AES was employed using the Cl(LMM) transition at 174eV. However, at the condition electron stimulated desorption (ESD) occurs. Cl decreased exponentially, which is due to quite efficient ESD. The decay time varies strongly with ΘCs. Thus it is very hard to determine So from AES in usual way. The strong decrease of decay time for ΘCs ＞0.3ML is interested. From this results we conclude that low Θalkali the Cl adsorbates are covalently bonded to the surface in the same way as on the clean surface. Around Θalkali 0.3ML this bond would change more ionic bond, leading to a higher ESD efficiency.

As a final method we measured the intensity of scattered the molecule at specular angle (Θi ＝ Θf ＝ 30°) and use it as a measure for So. The intensity of scattered Cl_2 is obtained at Ei＝0.09eV. The intensity first remain rather flat and subsequently increase to saturate at a certain number of shots. The intensity at initial stage starts to almost same value although Θalkali is changed. While higher Ei(0.45eV and 0.87eV), in this case the scattering intensity start to increase right from the start of Cl_2 shoots. Furthermore, there is clear difference between the clean and the alkali covered surface. For the clean surface scattered molecules are observed in the initial stage of Cl_2 shooting, in the case of ΘK＝1ML the scattering intensity is zero.

We obtain that the influence of the alkali metal is such that at low Ei(0.09eV) no promotion effect is observed(So 0.8). At high Ei(0.45eV , 0.87eV) the alkali promotion effect is observed(So was raised from 0.7 to 1).

Available Facilities and Equipment
