[V-10] [초청]

Halogen Etching of Si(100)-2x1: Dependence on Vacancy Creation and Surface Concentration

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We have studied the etching of Si(100)-2x1 by Cl and Br, using scanning tunneling microscopy to obtain morphological information that can be related to reaction and desorption pathways. Clean surfaces were exposed to molecular halogens at room temperature to produce well-defined chemisorption structures for coverages in the range 0.2-1.0 ML. Heating to 750-850 K induced etching by thermal desorption. Analysis of the halogen concentration before and after heating indicated that the rates of desorption for $SiCl_2$ or $SiBr_2$ were greatest for intermediate coverages and that etching was suppressed as saturation was reached. Hence, desorption is not simply proportional to the concentration of species that can form adsorbed precursors SiX_2(a). Instead, it is directly coupled to the creation of monomer vacancies adjacent to the SiX_2 (a) unit because this increases the lifetime of the excited state and increases the likelihood of its desorption. Increasing the surface concentration of halogens reduces the rate of vacancy formation. We show that these rates are also affected by a re-dimerization process in the high temperature Br-stabilized Si(100)-3x1 reconstruction that increases the likelihood of $SiBr_2$(a) formation and enhances its desorption. I will also discuss recent result for F etching on Si(100)-2x1.

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