[III-21] [초청]

Surface Reactions of Gas-Phase Hydrogen Atom with Adsorbed Species

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In recent years a number of experimental as well as theoretical studies have shown that the gas-phase hydrogen atom of thermal energy can readily abstract adsorbed species at surface temperatures at which the thermal reaction of adsorbed hydrogen with the adsorbed species by the Langmüir-Hinshelwood mechanism is virtually frozen; As an example, when Si(100) and metal surfaces covered with deuterium or halogen atom is exposed to a beam of hydrogen atom, a decrease in the surface coverage of adsorbate is observed even at 100K. The early investigations have invariably suggested without any evidence that the reaction may occur by the Eley-Rideal mechanism, i.e. by direct impact of the incident hydrogen atom with the adsorbate. Rettner and Auerbach performed detailed dynamic studies on the reaction, H(D) + D(H)(ad)/Cu(111), in which they measured the angular and velocity as well as the internal state distributions of the product HD molecules. They have shown that HD molecules are hot in all degrees of freedom, and the product angular distribution is correlated with the incidence angle of the beam. This memory effect is often taken as the evidence of the ER surface reaction, but it is not unequivocal.

At this point, it is of fundamental interest to understand the mechanism and dynamics of the so-called ER reactions. Such understanding will shed light into a more complex and practically important plasma-surface interactions on which modern thin film processing technology heavily relies. In this talk, I will briefly review the key experimental works concerning the mechanism of the abstraction reactions. Then, I will present some results of our recent studies to conclude that the hot atom mechanism is an important channel.

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