INVESTIGATION OF INITIAL STAGES OF HYDROGEN ADSORPTION IN CORNER PITS ON THE Si(111) 7× 7 SURFACE WITH Bi/W TIPS

S. Yu. Bulavenko, P. V. Melnik, M. G. Nakhodkin

Taras Shevchenko Kyiv National University
(64, Volodymyrska Str., Kyiv 03033, Ukraine)

S u m m a r y

The possibility of investigation of initial stages of hydrogen adsorption in corner pits of the Si(111)7× 7 surface is shown for the first time by scanning tunneling microscopy with Bi-covered W tips. The corner pit atoms of Si(111)7× 7 at the adsorption of hydrogen at room temperature are found to have the twice less activity than adatoms and rest atoms. Chemical activities of the atoms in corner pits, rest atoms, and adatoms do not agree with the binding energies of a hydrogen atom at each adsorption site (3.2, 2.9, 2.6 eV, respectively). Therefore, chemical activity of different adsorption sites on the Si(111)7× 7 surface to hydrogen at room temperature is defined by kinetic factors, for instance, by the sticking coefficient. Rearrangement of hydrogen atoms on the surface is shown to take place at heating, but the amount of adsorbed hydrogen in the corner pits is found to remain the same (at $T < 400$ ℃). This is the evidence for a high hydrogen diffusion barrier surrounding a corner pit. Desorption of hydrogen from the Si(111)7× 7 surface takes simultaneously place at 450 – 500 ℃ from all adsorption sites. A mechanism of hydrogen desorption from corner pits due to diffusion of hydrogen from adatoms to corner pits with formation of H_2 molecules is suggested.