

Surfactant mediated growth studied by scanning tunneling microscopy

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Surfactant mediated growth of Ge on Si has drawn much attention in strained layer heteroepitaxial growth. Group V elements have been used to suppress three dimensional islands, but they work as dopants at the same time. A newly designed, dynamically controlled flow of atomic hydrogen was used as a surfactant. Both the microscopic origin and the feasibility of hydrogen surfactant mediated growth of Ge on Si(001)-(2×1) surface were studied by the UHV scanning tunneling microscopy. Isotropic island growth, and limited surface diffusion of Ge adatom under atomic hydrogen exposure were observed. These could be explained by the favorable exchange between the preadsorbed hydrogen atom and the newly deposited Ge atom, which is consistent with the recent first principle calculation. By controlling the atomic hydrogen flux, it was possible to control the transition from hut cluster formation to the layer-by-layer growth mode.