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STM and photoemission study of self-organized Ge islands on the Si(114)-2×1 surface

Ganbat Duvjir[1], Otgonbayar Dugerjav[1], Hidong Kim[1], Jae M. Seo[1]

Department of Physics, Chonbuk National University

We have investigated Ge nano-facets grown on the Si(114)-2×1 surface [composed of dimer (R), tetramer (T), and rebonded atoms (R)] held at 500 ℃ using both by scanning tunneling microscopy (STM) and core level photo-emission spectroscopy (PES). At the Ge coverage of 0.3 ML, (113)-3×2 facets start to grow along the [1$\bar{1}$0] direction with surface trenches. Furthermore at the Ge coverage of 1.2 ML the surface predominantly forms one-dimensional (1D) sawtooth-like facets composed of (113) facets and opposing (117) facets. Finally at the Ge coverage of 2.4 MLs, sawtooth-like facets lose 1D symmetry by breaking nanofacets along the [1$\bar{1}$0] direction. From PES study, we have found that Ge atoms and Si atoms prefer upward relaxed surface (up) atoms and downward relaxed surface (down) atoms, respectively, at the submonolayer coverage. The relative concentrations of Ge in the down atoms and the sublayer atoms to the up atoms are found to be 12% and 5%, respectively.