[Nano device]

Atomic-scale structures on hydrogen-terminated Si(100) surface

T. Hashizume
Advanced Research Laboratory, Hitachi, Ltd., Hatoyama, Saitama, 350-0395, Japan

Atomic-scale one-dimensional structures on a hydrogen-terminated Si(100)-2x1-H surface are fabricated [1] and studied by scanning tunneling microscopy/spectroscopy and the first-principles calculations. The Si(100)-2x1-H surface has several properties suitable for fabricating atomic-scale devices, such as capability of atomic-scale dangling-bond patterning by using the tunneling current of the STM [1], passivated dangling-bond (DB) states of the Si dimer, and a high mobility of some metal atoms on the surface. The dangling-bond (DB) linear-chain structures (DB wires) made only of unpaired DBs show the Peierls instability, which is expected for one-dimensional metal systems and is resulting from the pairing of the second-layer Si atoms [2]. At temperatures near 100 K, a Ga atom on the Si(100)-2x1-H surface migrates in a nanoscale atom box confined by adjacent dimer rows and local dihydride defects, and is observed as a nanoscale linear protrusion (a Ga-bar structure). We find that the height of the Ga-bar structure maps out the local variation in potential energy at individual adsorption sites, which may be used as a local probe of defects or subsurface dopants [3].

In collaboration with : S. Heike, M. Fujimori, T. Hitosugi1, S. Matsuura1, S. Watanabe2 Y. Suwa, M. Ichimura, T.Onogi, Z. Q. Li3 , K. Ohno3, and Y. Kawazoe3
Advanced Research Laboratory, Hitachi, Ltd., Hatoyama, Saitama, 350-0395, Japan
1Department of Superconductivity, The University of Tokyo, Tokyo 113-8656 Japan
2Department of Materials Science, The University of Tokyo, Tokyo 113-8656 Japan
3Institute for Materials Research, Tohoku University, Sendai, 980-8577, Japan

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