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Band structure of Au monoatomic chains on Si(335) and Si(557) surfaces

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Abstract

The electronic band structure of the Si(557) and Si(335) surfaces covered with monoatomic Au chains produced in UHV conditions, is investigated in detail by angle-resolved photoelectron spectroscopy (ARPES), especially for the surface state bands near the Fermi energy. The ARPES spectra in the plane parallel to step edges for Si(557)-Au vicinal surface show strongly dispersive electron energy bands, characteristic of one-dimensional structure. The band dispersion is also calculated within tight-binding model, with two adjustable coupling parameters t_1 and t_2, for the first and second neighbors along the chains, respectively, and compared with that determined from the photoemission experiment. The scanning tunneling microscopy (STM) imaging and reflection high energy electron diffraction (RHEED) studies enabled us to determine atomic chain separation and its internal structure. The study shows that the structural anisotropy of these surfaces induces highly anisotropic electronic structure.