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High resolution photoemission spectroscopy study of the metal atomic wires on the stepped Si surface : Si(557)-Au and Si(553)-Au

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Atomic-scale wires created on semiconductor surfaces have the potential as a basis for nanoscale devices and to exhibit the novel physics in one dimension. An practical way to create such structures is provided by the use of stepped surfaces as templates. Recently, it was found that the 1D atomic chains on stepped Si surfaces with Au adsorbates, Si(557)-Au[1] and Si(553)-Au[2], exhibit metal-insulator transitions and periodic lattice distortions. However, the origins of the metal-insulator transitions are under debate and the details of the ground states are unclear at low temperature[3]. In this work, we performed high resolution core-level photoemission spectroscopy experiments for Si(557)-Au and Si(553)-Au surfaces. The experiments were performed on the 8A1 undulator beam line at Pohang Light Source (PLS). We found that the Au 4*f* spectra of each systems are independent of temperature, while the Si 2*p* spectra show subtle but noticeable changes. It is thus evidenced that the metal-insulator transition is not directly related to the Au chains but to the Si surface atoms. Furthermore, We assigned the specific temperature-dependent components of Si 2*p* spectra of each system as related to the Si atomic chains of step edge. These results are consistent with those of the recent STM study[1].

[Reference]
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