

Surface Structures of SrTiO₃(001) and Ni/SrTiO₃(001) Studied by Medium Energy Ion Scattering and SR-photoelectron Spectroscopy

Yoshiaki Kido, Tomoaki Nishimura, Yasushi Hoshino and Hidetoshi Namba

Abstract

The surface structures of SrTiO₃(001) and Ni(1-ML)/SrTiO₃(001) were studied by high-resolution medium energy ion scattering (MEIS) coupled with ultraviolet photoelectron spectroscopy (UPS) using synchrotron radiation. The present MEIS analysis showed that the fraction of TiO₂ face was about 90 % for the SrTiO₃(001) surface etched in an NH₄F-HF buffer solution (pH: 3.5 - 3.8) followed by annealing in O₂-atmosphere. Annealing in ultrahigh vacuum (UHV) at temperatures higher than 650°C generated O-vacancies in the top TiO₂ plane, which was confirmed directly by UPS. Our MEIS analysis also revealed the fact that the fraction of TiO₂ face was decreased by 5-6 % and the ratio of 14 % of the O site in the top TiO₂ plane became vacant by annealing in UHV at 650°C for 1 h. Deposition of one monolayer (ML) Ni onto the clean 1 × 1 SrTiO₃(001) surface led to a metallic nature, which was observed by UPS. Reflective high energy electron diffraction analysis showed that the deposited Ni atoms took random sites and subsequent annealing at 400°C in UHV led to formation of single crystal clusters on the surface.