[Ⅲ~10][초청]

Preparation , Characterization and Reactivity Studies of Au/TiO2/Mo(100)

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Ultrathin (100 A) titanium oxide films were synthesized on the Mo(100) surface and characterized using various surface science techniques. Epitaxial TiO_2 films of varying film thickness were prepared by evaporating titanium in an oxygen background (5×10^{-7} Torr) between 500 K and 700 K, followed by annealing to 900-1200 K. The growth, composition, and structure of the TiO_2 films have been investigated using ion scattering spectroscopy (ISS), low energy electron diffraction (LEED), X-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES) and scanning tunneling microscopy (STM). A reconstructed (22 x 2)R45° LEED pattern was observed after annealing to between 900 K and 1200 K in vacuum with 5.0 and 30 ML film thicknesses. LEED and STM results show that the TiO_2 films with a coverage of 5.0 and 30 ML order along the 010 and 001 direction of the Mo(100) substrate. XPS data show that 30 ML TiO_2 films exhibit only the Ti^{4+} valence state, whereas 1.6 and 5.0 ML titanium oxide films are partially reduced and exhibit the Ti^{3+} and Ti^{2+} states as well. ISS was used to determine the growth mode of titanium oxide films on Mo(100) surface within the first monolayer. ISS measurements of unannealed titanium oxide films show that TiO_2 films wet the Mo(100) surface well.

The growth, thermal stability and reactivity of Au supported on the TiO_2(001)/Mo(100) surface have also been studied using ISS, XPS, STM and temperature desorption spectroscopy (TPD). With increasing Au coverages, the substrate TiO_2 ISS peak intensity decreases rather slowly. Even at an Au equivalent coverage of 5.0 ML, the substrate ISS signal is attenuated only by 80 % at a sample temperature of 300 K. This result clearly demonstrates a three dimensional growth mode for Au on the TiO_2(001)/Mo(100) surface. The thermal stability of 1 ML Au on the TiO_2(001)/Mo(100) was investigated using ISS, TPD and XPS. By annealing Au/TiO_2(001)/Mo(100) up to 900 K, the Au islands grow continuously; Au starts to desorb at 900 K. XPS measurements show only the Ti^{4+} valence state, indicating no encapsulation of Au.
A STM image of the 1.8 ML Au/TiO_2/Mo(100) surface shows hemispherical Au clusters with a relatively narrow size distribution. The density of Au clusters on TiO_2 is higher than on MoO_x, indicating a stronger interaction between Au and TiO_2 than between Au and MoO_x.