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## **1. Highlights in 2008**

### **1) Surface electronic states of atomically flat, ultra-thin Ag(111) films**

We investigated the electronic states of atomically flat, ultra-thin Ag(111) films obtained by observing the surface electron standing waves and electron density of states using scanning tunneling microscope (STM). As a result, we found the surface state with the two-dimensional free electron dispersion survives at the coverage above 5 atomic monolayer (ML). However, the bottom of the surface states shifts upward and the effective mass becomes lighter with the decrease of the Ag(111) film thickness. Furthermore, we found that the surface state dispersion is locally swayed by step-step dislocation of the Ag ultra-thin surface and quantum confinement in Ag atomic monolayer island.

### **2) Artificial control of the critical thickness in the electronic growth**

In ultra-thin Ag films of nanometer thickness, the most atomically flat films can be obtained by the competition between the valence electron quantum confinement in ultra-thin films and dipole creation by electron transpiration at the interface. We found that the critical film thickness in the electronically grown, atomically flat Ag(111) films can be shifted artificially by controlling interfacial quantum confined potential with the insertion of hydrogen atoms to the Ag(111) ultra-thin films/Si(111) substrate interfaces.

## **2. The list of publications (original article, comment/book)**

### **1) Original Paper**

- (1) Electron Confinement in a STM-lithographed Nanoscale Domain on an Si(111) $\sqrt{3}\times\sqrt{3}$ -Ag Surface at Room Temperature : S.Minamoto, T.Ishiduka & H.Hirayama : Surface Science 602, pp.470-474(2008)
- (2) Thickness- and Deposition Temperature-dependent Morphological Change in Electric Growth of Ultra-thin Ag Films on Si(111) Substrates ; M.Miyazaki & H.Hirayama : Surface Science 602, pp.276-282(2008)
- (3) An STM study of Ge heteroepitaxial Growth on Si(111) $\sqrt{3}\times\sqrt{3}$ -B Surfaces ; T.Sekiguchi & H.Hirayama : Surface Science 602, pp.3279-3283(2008)
- (4) Scattering Potential Evaluation with S+P+D Wave Expansion of a Vacancy Complex on a Si(111) $\sqrt{3}\times\sqrt{3}$ -Ag Surface ; S.Minamoto & H.Hirayama : Materials Science & Engineering B (in press)
- (5) Growth of atomically flat ultra-thin Ag films on Si surfaces ; H.Hirayama : Surface Science (in press)

## **3. Invited/Plenary Talks in Conference**

### **1) International Conference or Workshop**

- (1) H.Hirayama; "Nanostructures and their electronic states at surfaces"; New Zealand-Tokyo Institute of Technology Seminar on Nanotechnology, Ohokayama, January 30, 2009 (Invited Talk)
- (2) H.Hirayama; "Quantum confinements at surfaces" ; Tokyo Tech-Tsinghua University Joint

Symposium, Tamachi, November 19, 2008(Invited Talk)

- (3) Y.Aoki,T.Sugimoto,H.Hirayama; "Desorption of Atomic Hydrogen adsorbed on ultra thin Ag(111) film" : International Symposium on Integrated Molecular/Materials Engineering (ISIME2008) (Invited Talk) Xian, China, November 6-7, 2008
- (4) K.Sawa,Y.Aoki,H.Hirayama; "Surface Electron Scattering at Dislocations on Atomically Flat Thin Ag Films" ; 4th Vacuum and Surface Sciences Conference of Asia and Australia (VASSCAA-4),Matsue, 29B11, October 29, 2008 (Oral)
- (5) H.Hirayama,M.Miyazaki; "Controlling the Magic Thickness in Electronic Growth of Atomically Flat Ag Films on Si(111) Substrates": 2008 International Conference on Nanoscience+Technology (ICN+T2008),Keystone,CO.U.S.A, NM2-WeA4, July 23,2008 (Oral)

## 2) Domestic Conferences

- (1) Y.Toda,Y.Kubota,H.Hirayama,H.Hosono; "Clean surface preparation and STM study on C12A7 electrude" COST D41 WG4 workshop (AFM/STM imaging and manipulation of insulating surface and films) London, UK, April 17,2008 (Oral)
- (2) S.Minamoto, H.Hirayama; "Partial wave approximation of scattering of the S1-surface state electron by an isolated adatom at Si(111) $\sqrt{3}\times\sqrt{3}$ -Ag surface at room temperature": STAC2-STSI1, Makuhari, May 31,2008 (Oral)
- (3) Y.Toda,Y.Kubota,S.Matsuishi,T.Kamiya,M.Hirano,H.Hirayama,H.Hosono; "Surface modification and STM study of inorganic electrude C12A7e-": STAC2-STSI1, Makuhari, May 30,2008 (Oral)