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Electronic structure of p(2 x 3) Ag films on Si(100)

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The electronic structure of p(2 x 3) Ag films on Si(100) is studied by electron energy loss spectroscopy (EELS) and scanning tunneling spectroscopy (STS).

We observe three energy loss peaks with their loss energies around 1.28, 1.63 and 4.0 eV. They are assigned to the interband transition in the p(2 x 3) islands, the interface plasmon between Si(100) and Ag crystallites formed concomitantly with the p(2 x 3) islands, and a combination of the surface plasmon and interband transitionof the Ag crystallites, respectively. STS over the p(2 x 3) surface also reveals a band gap around 1.2 eV in good agreement with EELS observation of the interband transition. The present observation of the band gap suggests that the p(2 x 3) surface is semiconducting.

Furthermore, we examine two models previously proposed for the p(2 x 3) surface against the present experimental observation by both ab initio band structure calculations and the simulation of scanning-tunneling-microscope (STM) images.It is found that both models, in their original forms, can neither account for the semiconducting nature of the p(2 x 3) surface concluded from the present study, nor reproduce the reported STM images.