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Atomic Structure and Growth of Ag on Si(001) at High Temperature

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Metal/silicon systems have been studied for better understanding of the interface properties. One of the most interesting systems is Ag/Si because it is relatively non-interactive and atomically abrupt. Even though there is controversy on the critical thickness, it is believed that the growth of Ag on Si(001) is Stransky-Krastanov(SK) mode at room temperature and at higher temperature.

All experiments were performed in an ultrahigh vacuum chamber having a base pressure of 2×10^{-10} Torr. The chamber was equipped with a coaxial impact collision ion scattering spectroscopy(CAICISS) system, a four-grid LEED optics, and facilities for sample heating and metal deposition. The Si(001) sample was cut from silicon wafer, chemically cleaned immediately before introduction to the chamber, and then outgassed by heating to 700℃ at a pressure of less than 2×10^{-9} Torr. After outgassing, it was flashed to 1000℃ for a few seconds. The sample was characterized by LEED at RT. Ag was evaporated from a tungsten filament onto substrate at 600℃. The temperature was measured with a pyrometer. The final Ag coverages were determined from Rutherford backscattering spectroscopy (RBS).

In this work, we studied atomic structure and growth mode of Ag on Si(001) surface at a substrate temperature of 600℃ by CAICISS. After deposition at 600℃, Ag grows in the SK mode. That is, Ag shows 3D island structure as in the bulk structure, and also shows 2D layer structure in the surface.

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