

# Size effects and influences of lattice defects on the behavior of conduction electrons in Ag island particles.

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Size effects and influences of lattice defects on electronic properties of Ag island particles have been studied by observing with electron microscope and measuring the optical plasma resonance absorption.

From the investigation of the change in the particle shape due to the surface energy reduction, it was found that the particle shape depends both on the surface energy and the particle size, and that the particles on the fused SiO<sub>2</sub> substrate are almost spherical below a diameter of about 7nm. Below this size, the particle shape is identical and the half width of the absorption is easy to analyze.

For the particles from 0.8 to 6nm in diameter, the size dependence of the half width and of its change with temperature were investigated by considering the size dependence of the average energy level spacing and the level broadening. It was shown that the quantum size effect is valid from about 2nm and the classical size effect is valid from about to 3nm, and that the influence of lattice defects appears above about 3nm.

The lattice-defect scattering frequencies calculated from the half width showed that above about 3nm the lattice defect density increases with particle size. This size dependence could be interpreted by the particle growth due to the agglomeration, which forms lattice defects.

The change in the absorption due to sulfurization was investigated. It was found from this investigation that sulfurization occurs at lattice defects in the particles also.