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Electron energy-loss spectroscopy study of surface plasmons in Au nano-particles. CHENG-HSUAN CHEN, MING-WEN CHU, Center for Condensed Matter Sciences, National Taiwan University, Taipei, Taiwan, JIN-PEI DENG, CHUNG-YUAN MOU, Department of Chemistry, National Taiwan University, Taipei, Taiwan — We have studied the surface plasmon excitations of ~ 10 nm Au nano-particles with various shapes (such as sphere, rod, and triangle) by electron energy-loss spectroscopy (EELS) using a 0.2 nm electron probe in a scanning transmission electron microscope (STEM). EELS spectra were investigated as a function of distance from the probe to the nanoparticle surface, i.e., the impact parameter, and four surface plasmon peaks at 10, 15, 24, and 33 eV could be identified in the loss spectra in the 10 to 40 eV range where the dielectric constant of Au is positive (and still less than one). These high energy surface excitations are anomalous and in sharp contrast to the well-known surface plasmon of Au at 2.4 eV in the visible spectral range where the dielectric constant is negative. Spectral imaging studies also conclusively show that these high energy surface excitations are indeed localized at the surface of the nano-particles.

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