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Tuning surface plasmon resonances of Ag nanoparticles[1] DEXIN KONG, LIYING JIANG, JOSÉ MENÉNDEZ, JEFF DRUCKER, Arizona State University — The localized surface plasmon resonance (LSPR) of metallic nanoparticles can be tuned by varying their size, shape and dielectric environment. Using spectroscopic ellipsometry, we investigate the LSPR energy of epitaxial Ag islands grown atop Si(100) and conclude that it can be tuned from the near-UV to the near-IR. We use two island sizes, 25 nm and 100 nm. Subsequent to Ag island growth, we deposited 30 nm equivalent thickness layers of Si or TiO_2 onto selected samples, enabling characterization of the epitaxial Ag island LSPR energy as a function of size and dielectric environment. For the bare Ag nanoparticles, we found that 25 nm Ag islands only show the dipolar LSPR (around 3.2 eV), and that the dipolar LSPR of 100 nm particles is located around 3.0 eV. The sample of 100 nm Ag islands also shows the multi-pole LSPR and bulk plasmon resonance. For 25 nm particles, the TiO_2 layer redshifts the LSPR to about 2.0 eV and the Si layer further redshifts the LSPR peak to around 1.1 eV. The TiO_2 layer redshifts the plasmon peak of the 100 nm islands to about 1.7 eV, and the Si layer shifts it to near 1.4 eV. These resonance energies semi-quantitatively agree with a simple analytical estimate of the dipole plasmon resonance.

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