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Plasmonic hysteresis: temperature dependent resonance of vanadium-dioxide coated gold nanoparticle arrays[1] DAVON FERRARA, JOYEETA NAG, EUGENE DONEV, JAE SUH, RICHARD HAGLUND, Vanderbilt University — The optical properties of metal nanostructures are dominated by the free-electron, or plasmonic, response of the material. In the case of metal nanoparticles, this leads to a resonant extinction with wavelength determined by the particles' size, shape, material, and surrounding dielectric. Vanadium-dioxide has a hysteretic transition from a semiconductor to a metal about 68C accompanied by a change in its structural, electrical and optical properties. Using vanadium dioxide as a thermochromic dielectric switch, we map out the hysteresis of the plasmonic resonance of gold nanoparticle arrays coated with the metal-oxide as a function of temperature. To study this plasmonic dependence on temperature, a sample of 20nm thick Au nanoparticle arrays with various particle sizes and grating constants were coated with a 60nm thick vanadium dioxide film. We find that near the transition, the particle plasmon resonance can shift position over 250nm. Measurements of the line shape show the effects of strong correlation in the vicinity of the switching temperatures.

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