Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Size-dependent optical properties of VO2 nanoparticle arrays

RENE LOPEZ, LEONARD C. FELDMAN, RICHARD F. HAGLUND JR., Department of Physics, Vanderbilt University — Arrays of vanadium oxide nanoparticles with long-range order have been fabricated by pulsed laser deposition in an arbitrary pattern defined by focused ion-beam lithography. Interaction of light with the nanoparticles is controlled by the geometrical arrangement as well as by the differing optical properties displayed by the metallic and semiconducting phases of VO_2. Contrary to previous VO_2 studies, we observe that the optical contrast between the semiconducting and metallic phases is dramatically enhanced in the visible region, presenting size-dependent optical resonances and size dependent transition temperatures. The collective optical response as a function of temperature presents an enhanced scattering state during the evolving phase transition. The effects appear to arise because of the underlying VO_2 mesoscale optical properties, the heterogeneous nucleation behind the phase transition and the incoherent coupling between the nanoparticles undergoing an order-disorder-order transition. Arrays such as this open up new opportunities to study surface plasmon interactions for nanoparticles in close proximity, with the added advantage that the interaction can be switched on by the thermally driven metal-semiconductor phase transition in VO_2. This research was supported by the NSF-NIRT program (DMR0210785).

Rene Lopez

Date submitted: 30 Nov 2004 Electronic form version 1.4