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Modifying the visual appearance of metal nanoparticle composites by infrared laser annealing ANDREJ HALABICA, Vanderbilt University, J. C. INDROBO, R. H. MAGRUDER III, R. F. HAGLUND JR., J. M. EPP, S. RASHKEEV, L. A. BOATNER, S. J. PENNYCOOK, S. T. PANTELIDES — It has long been known that noble-metal nanoparticles in insulators can alter their visual appearance. Many metal nanoparticle composites can be created by ion implantation and subsequent annealing to initiate phase separation, nucleation and growth of nanoparticles. The size and size distribution of the nanoparticles - and therefore the color of the composite - are determined by the chemistry and thermodynamics of the annealing process. In this paper we report that we can also alter the color of gold- and silver-implanted silica and alumina by tunable infrared laser irradiation. Essentially a variant of rapid thermal annealing, this laser treatment can shift the plasmon band of the nanoparticles by tens of nm, resulting in significantly altered visual appearance. The amount of energy delivered to the implanted layer, and the subsequent color variation, can be adjusted by changing the wavelength and fluence of the laser. This makes it possible, as we will show, to write or pattern the composite material with 200 μm linewidths. This work is partially supported by DOE (DE-AC05-00OR22725), NSF (DMR-0513048), and by Alcoa Inc.

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