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Spectroscopic ellipsometric studies of randomly distributed plasmonic Gallium nanoparticles YANG YANG, Physics Dept, Duke, TONG-HO KIM, ECE Dept, Duke, NESET AKOZBEK, AEgis Technologies, APRIL BROWN, ECE Dept, Duke, HENRY EVERITT, Physics/ECE, Duke; Bowden Laboratory, Army Aviation and Missile RD&E Center — Ultraviolet surfaced-enhanced Raman scattering (UV-SERS) was recently observed using randomly distributed Gallium nanoparticles (Ga NPs) deposited on sapphire by molecular beam expitaxy at room temperature. Atomic force and scanning electron microscopies revealed that the radii of the hemispheroid NPs follow unimodal or bimodal pseudo Gaussian distributions whose mean diameters increase with increasing Ga dosage (i.e. growth time). Variable angle spectroscopic ellipsometric measurements were then performed on Ga NP ensembles to explore the correlation between the polarimetric optical response and the local morphology. An effective medium composed of single or double Lorentzian oscillators was found to reproduce the optical response of Ga NP ensembles with resonance frequencies that decrease monotonically with increasing NP size. In addition, a strong depolarization response was observed for near-normal incidence. Interestingly, the sample for which the depolarization peak was closest to the 325nm laser excitation wavelength was the sample with the highest SERS enhancement factor.

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