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Optical Properties of GaAs Nanoparticles in Acetone by Laser Ablation

Abstract:

Gallium arsenide (GaAs) nanoparticles' optical and emission properties can be tuned by changing their size across the visible spectrum. GaAs nanoparticles' optical characteristics are degraded by oxidation on their surface. This work investigated the optical constants and the optical band gap for a GaAs nanoparticle immersed in acetone using the laser ablation into liquids (LAL) technique after being exposed to a Nd: YAG pulsed laser operating at the wavelength (1064nm) 10Hz frequency, and 7ns pulse width for a fixed flounce of 1.32 J/cm2, and the time of ablation was 5 minutes. In order to calculate the optical conductivity (σ), refractive index (n), extinction coefficient (k), dielectric constant, absorption coefficient (α), and optical band gap, an optical investigation was carried out utilizing a UV-Visible Spectrophotometer region in the wavelength range 300-1200 nm. The band gap energy was determined to be 3.8 eV, which is greater than the bulk Ga energy. The band gap energy of nanoparticles increases with increasing laser pulse energy and decreases with increasing pulse repetition rate. Transmission spectra increased as wavelengths increased, while optical absorption coefficients, extinction coefficients, and refractive coefficients decreased. The difference in optical constants is explained by defect states and the average band energy of the system. The acetone stability test reveals a peak at -0.69 mV, indicating low stability in nanoparticles.