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Infrared and Raman Spectroscopy of ZnO Nanoparticles

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ZnO is a wide-bandgap semiconductor with emerging optoelectronic applications. In this work, the optical and electrical properties of as-grown and hydrogen-annealed ZnO nanoparticles were investigated. Infrared (IR) reflectance spectra show a dramatic increase in free carrier concentration in the hydrogen- annealed nanoparticles. A difference is observed reststrahlen line shape of the conductive sample compared to that of bulk sample. The effective medium approximation was applied to model the reflectance spectra. The agreement between experimental results and modeling approach suggests that the nanoparticles have inhomogeneous carrier concentrations. In addition, Raman spectroscopy and electrical conductivity measurements were also performed to probe the carrier properties.