Size-dependent Effective Refractive Index of CsPbBr3 and Ag Nanoparticles: Experimental Validation of the Maxwell-Garnett Model

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This study aims to experimentally validate the Maxwell-Garnett effective medium theory by comparing refractive index behavior of semiconductor ($CsPbBr_3$) and metallic (Ag) nanoparticles embedded in a transparent matrix. The focus is on how particle size affects the effective optical properties and how these trends differ between materials with excitonic versus plasmonic behavior.

Very small nanoparticles were used in colloidal form. To measure the refractive index, an interferometric technique was employed, allowing precise determination of the refractive index for each concentration. The measured refractive index of the solution, along with the known refractive index of the solvent, the absorption coefficient, and the volume fraction of the nanoparticles, were applied to the Maxwell-Garnett effective medium approximation (EMA) model to calculate the intrinsic refractive index of the particles.

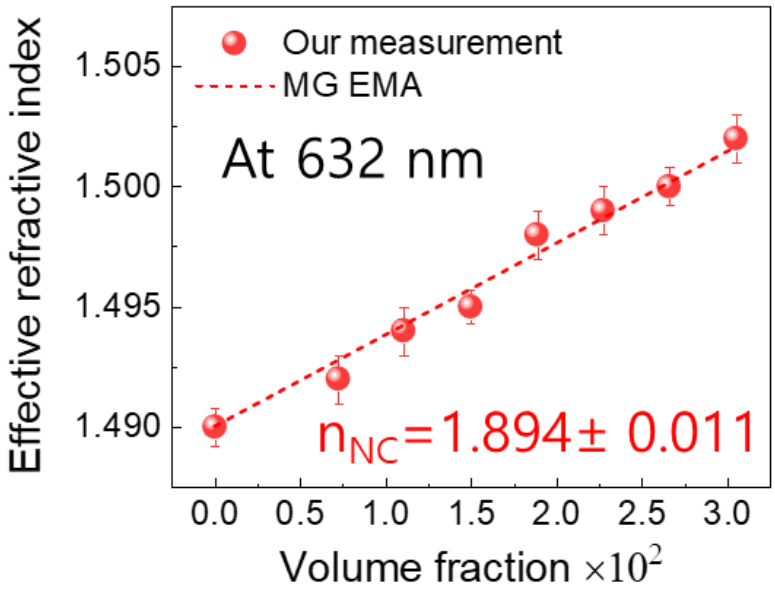

Figure 1: $CsPbBr_3$ solution refractive index and nanocrystal refractive index from Maxwell-Garnett model fit

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