# NUMERICAL ANALYSIS OF HIGH-INDEX NANO-COMPOSITE ENCAPSULANT FOR LIGHT-EMITTING DIODES

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## ABSTRACT

We used two-dimensional Finte-Difference-Time-Domain (FDTD) software to study the transition behavior of nano-particles from scatterers to an optically uniform medium. We measured the transmission efficiency of the dipole source, which is located in the high refractive index medium(index=2.00) and encapsulated by low index resin(index=1.41). In an effort to compose index-matched resin and to reduce internal reflection, high-index nano-particles are added to low-index resin in simulations of various sizes and densities. As the size of the nano-particles and the average spacing between particles are reduced to 0.02 and 0.07 respectively, the transmission efficiency improves two-fold compared to that without nano-particles. The numerical results can be used to understand the optical behavior of nano-particles and to improve the extraction efficiency of high brightness light-emitting-diodes(LEDs), through the use of nano-composite encapsulant.
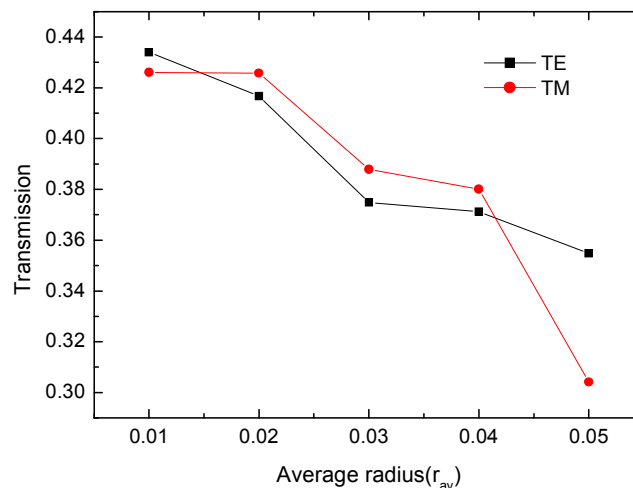
Fig. 1. Transmission efficiency as a function of the average radius of nano-particles($r_{av}$). $a_{av}$ is adjusted at every point so that the simple average index is 2.0.