Particle Dispersion Model for Predicting the Percolation Threshold of Nano-Silver Composite

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Abstract

In the current study, particle dispersion models of electrically conductive adhesives are developed through establishing the effects of 80 nm of silver (Ag) particles by employing van der Waals attraction energy, which acts as an energy of interaction of p articles that are embedded in an epoxy solution system. The arrangement of the particle dispersion in the epoxy colloidal system is determined by identifying the morphology in the experimental works. The characteristics of particle dispersion are analyzed based on electrical conductivity effect with respect to the volume fraction factor, which is set in the range of 2 –8 vol%. In developing the particle dispersion model, the model was simulated through representative volume elements (RVEs) by implementing th e standard error of the RVE size model versus electrical conductivity (S/cm ^{2}). The model size was determined by the ratio between the width of the RVE model and the particle size, which was set as 3, 4, 5, 6, 7, and 8. The accurate size that represents the precision of the estimation of the electrical conductivity result has been successfully determined by a particle dispersion model developed at a model size of $\delta = 6$. A significant improvement in the optimization of the particle dispersion model's synergis tic effect on electrical conductivity has been obtained with new techniques in relation to the experimental data. The numerical results were almost the same as the experimental results, where the percolation threshold occurred at a filler loading of 6 vol% and reached at 1.32 × 10 $^{-1}$ S/cm

Keywords: Particle dispersion , van der Waals , Critical distance , Electrical conductivity , Spherical particle , RVE

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