Effects of Nanoparticle Size and Aggregation on Metal Nanoparticle-Polymer Thermal Interface Materials

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**Objective**
- Fabricate metal-polymer nanocomposite
- Characterize thermal conductivity and aggregation structure
- Develop new EMA model to include particle size, type, concentration, aggregation effect and interfacial resistance

**Approach**
- Nanocomposites are fabricated with epoxy and nickel particles.

**Impact**
- Aggregation effect is responsible for the size-dependent enhancement of thermal conductivity.
- 2-level EMA model considers aggregation effect by assuming clusters as new particles.

3\(\omega\) method is used for thermal conductivity characterization.

Thermal conductivity characterization shows higher value than Maxwell predicts and size-dependent enhancement, where smaller particles yield higher thermal conductivity. Both effects are considered attributed to aggregation effect.

Dispersion and aggregation of particles are shown through TEM figures.

(a) 20nm 5.7v%  (b) 70nm 5.5v%

A more spread-out aggregation structure with smaller particles are more beneficial for thermal transfer.

Fabrication process for nickel-epoxy nanocomposites.