Superior Thermal and Electrical Conductive MLGS and FLGS Filled Polymer Composites

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Currently there is great interest in graphene-based devices and applications. The main advantages of graphene include excellent conductivity and mechanical properties. The applications of graphene cover a wide range of possibilities, from conductive, light-weight and high-strength composite materials to next generation smarter and faster electronics and semiconductors. However, commercial use of graphene will depend on the development of an industrially-viable method of fabricating and handling of it.

Our current advances focused on high throughput Top-down Graphene manufacturing approach with graphite as initial material for “Multi and Few Layer Graphene Sheets” (MLGS and FLGS) synthesis and its related applications.

We developed a bulk manufacturing method for FLGS with great mixing potential and balanced hydrophobicity with highly compatibility with various processes of organic based composites. The sheet-like morphology of the FLGS nanostructures was confirmed by transmission electron microscopy, which also demonstrated that the number of layers within the sheets varied from three to ten.

In this research, FLGS were used to make composites to achieve higher electrical and thermal conductivity. The compounded composites show high conductivity (both electrical and thermal) properties. Compared to previously reported Nano Graphene Platelets (NGPs)/Epoxy composites, at room temperature, for heat conductivity in particular, is at least 150 times greater than that of pure epoxy resin and exceeds 34 W/mK, due to the percolation network of MLGS, while specific solid loadings not exceeding 20 percent of the total weight. This composite also has a high electrical conductivity, with the same composition of solid loading of 20 percent, value of $5.90\times10^{-2}\Omega$.cm, attained for electrical resistivity that shows much higher conductivity behavior compare to previously reported data.

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