Boron Nitride Nanosheets From Different Preparations And Their Use In Polymeric Nanocomposites For Thermally Conductive Yet Electrically Insulating Materials

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Abstract

There are growing technological needs for materials and systems of the high thermal conductivity decoupled from electrical conductivity. High quality boron nitride nanosheets (BNNs) represent an excellent platform for this purpose because they are thermally conductive yet electrically insulating, and in addition they are known for their excellent chemical and thermal stabilities, and strong resistance to oxidation even at elevated temperatures. These unique materials will have broad and important applications ranging from ultrahigh-performance electronics to high-speed vehicles and to systems operated under some extreme conditions. For such applications, high-quality BNNs that are thinner, larger in lateral dimension, and of less surface and edge defects are desired, yet their facile production still remains a significant challenge. In this work, we examined various solvent systems and experimental conditions for the exfoliation of commercially acquired hexagonal boron nitride into BNNs and their ability to form relatively stable dispersions. The more stable dispersions were used for the fabrication of polymeric nanocomposites and explored for higher thermal conductive performance. Morphology and structure of the resulting BNNs and their based nanocomposites were characterized by powder X-ray diffraction (XRD), field-emission scanning and transmission electron microscopy (SEM and TEM), FT-IR, and thermal conductivity.