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Thermal conductive composites reinforced *via* advanced boron nitride nanomaterials

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ABSTRACT

The demand for insulating polymeric composites with high thermal conductivity has increased remarkably for electronic packaging. Since polymers usually suffer from low thermal conductivity, boron nitrides (BN) are emerging as advanced fillers in polymeric composites. BN nanomaterials strikingly reinforce thermal conductivity of polymers and simultaneously improve insulation, thermal expansion, and dielectricity. We herein introduce diverse BN nanomaterials and summarize the progress about thermal conductive composites with various BN fillers from 0D BN particles *via* 1D nanotubes to 2D nanosheets. 3D fillers, multi-scale and multi-dimensional mixed BN fillers developed recently are also presented. The functionalization and the controlled orientation of fillers are reviewed, and current challenges towards higher thermal conductivity of BN/polymer composites are additionally discussed.

Keywords: Boron nitride; Thermal conductivity; Polymeric composite; Dimension

1. Introduction to boron nitride nanomaterials

Boron nitride (BN) low-dimensional materials can be traced back to 1990s [1], following carbon fullerene [2], which have been ascending [3,4]. The development of BN nanomaterials is bound with their graphitic counterparts as similar bond energy but different frontier electron structures between graphite and hexagonal BN [5-7]. BN implements wide

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