

Polymeric Nanocomposites of Boron Nitride Nanosheets for Enhanced Directional or Isotropic Thermal Transport Performance.

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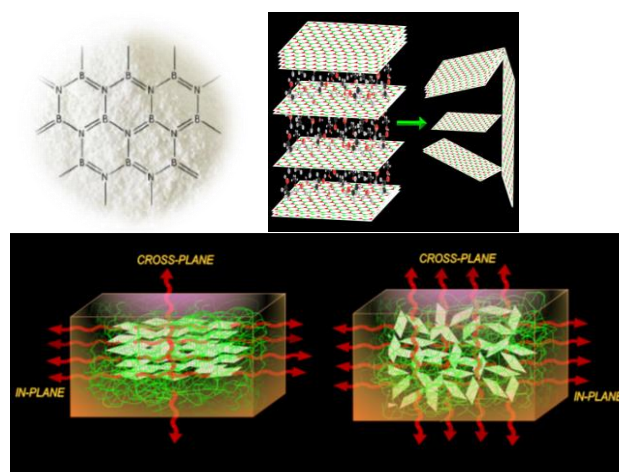
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Abstract

Thermal management has become increasingly critical in a number of cutting-edge and emerging technologies, from advanced semiconductor chips, various battery technologies, power generation and other industrial applications. Consequently, the development of advanced materials capable of efficient thermal management has become indispensable in recent years to improve device performance, extend operational lifetime, and ensure reliability and safety. Boron nitride nanosheets (BNNs) provide an attractive platform for such applications because they combine high thermal conductivity with excellent electrical insulation and exhibit excellent chemical and thermal stability, making them well suited for operation under demanding conditions. For optimal performance, however, high-quality BNNs that are ultrathin, larger in lateral dimension, and of less defects are desired, yet their facile production remains a significant challenge. In this work, we investigate various systems and experimental conditions for the exfoliation of commercially acquired hexagonal BN into BNNs and their ability to form relatively stable dispersions. The exfoliated BNN materials were dispersed into polymer matrices for fabricating nanocomposites thin films with tailored directional thermal transport properties. 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



Recent Publications

1. Wang, Z. D.; Meziani, M. J.; Patel, A. K.; Priego, P.; Wirth, W.; Wang, P.; Sun, Y.-P. *Ind. Eng. Chem. Res.* **2019**, *58*, 18644-18653.
2. Wang, Z.; Priego, P.; Meziani, M. J.; Wirth, k.; Bhattacharya, S.; Rao, A.; Wang, P.; Sun, Y.-P. *Nanoscale Adv.* **2020**, *2*, 2507-2513.
3. Nwanonenyi, C. C.; Patel, A. K.; Wang, P.; Wang, Z. D.; Wirth, K.; Zaharias, M.; Sun, Y.-P.; Meziani, M. J. *J. Supercritical Fluids* **2021**, *167*, 105035.
4. Meziani, M. J.; Sheriff, K.; Parajuli, P.; Priego, P.; Bhattacharya, S.; Rao, A. M.; Quimby, J. L.; Qiao, R.; Wang, P.; Hwu, S.-J.; Wang, Z. D.; Sun, Y.-P. *ChemPhysChem* **2022**, *23 (1)*, e202100
5. Cao, L.; Singh, B.; Han, J.; Yerra, S.; Elfaki, IEA.; Meziani, M. J.; Sheriff, K.; Sun, Y.-P. *Chem. Phys. Lett.* **2026**, *890*, 142742

Biography



Dr Mohammed Jaouad Meziani received his B.S. (1994) degree in chemistry from the University of Mohamed I in Morocco, and both his M.S. (1995) and Ph.D. (1999) degrees in physical and analytical chemistry from the University of Montpellier II in France under the supervision of Dr Stanislas Partyka and Dr Deborah Jones. He then worked as a senior research associate with Prof. Ya-Ping Sun in the Department of Chemistry at Clemson University in USA. He is currently a Professor at the Northwest Missouri State University. His research is in the development of nanostructures and nanomaterials for optical, electronic, and biomedical applications. He published more than 115 papers in peer-reviewed journals.

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