Accepted Manuscript

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PII: S1359-835X(17)30167-7
DOI: http://dx.doi.org/10.1016/j.compositesa.2017.04.018
Reference: JCOMA 4645

To appear in: *Composites: Part A*

Received Date: 10 February 2017
Revised Date: 10 April 2017
Accepted Date: 23 April 2017

Please cite this article as: Fang, H., Bai, S-L., Wong, C.P., Thermal, mechanical and dielectric properties of flexible BN foam and BN nanosheets reinforced polymer composites for electronic packaging application, *Composites: Part A* (2017), doi: http://dx.doi.org/10.1016/j.compositesa.2017.04.018

Thermal, mechanical and dielectric properties of flexible BN foam and BN nanosheets reinforced polymer composites for electronic packaging application

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Abstract:

A series of novel flexible polymer composites consisted of boron nitride foam (BNF), boron nitride nanosheets (BNNS) and polydimethylsiloxane (PDMS) were designed and fabricated by vacuum-assisted infiltrating BNNS/PDMS mixtures into 3D BNF synthesized via chemical vapor deposition (CVD). Their microstructure, thermal, mechanical and dielectric properties were studied. Contributed to the interconnected networks of BNF and synergistic effect of BNNS with BNF, 10wt% BNNS/BNF/PDMS composite shows a high thermal conductivity of 0.56 W m^{-1} K^{-1}, high heat resistance index of 275.6 °C, 33% increment of Young's modulus compared to PDMS, relative permittivity of 3, dissipation factor of 0.0051, EMI shielding effectiveness of 1.5dB at X band and breakdown strength of 21.8 MV/m. Due to the outstanding comprehensive properties, BNNS/BNF/PDMS composites have a promising potential application in wide electronic packaging field.

Keywords: Boron nitride foam; boron nitride nanosheets; polymer composites, thermal property; dielectric property;

Heat management is one of the most crucial challenges in current electronic packaging due to the rapid development in miniaturization and integration of microelectronic devices. In order to dissipate the large heat flux from high power electronic devices for better performance and longer longevity, development of thermal interface materials (TIMs) with high thermal