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SUPPORTING INFORMATION

Enhanced Thermal Properties in a Hybrid Graphene-Alumina Filler for Epoxy Composites

Cen Zeng[1], Shaorong Lu[1]*, Laifu Song[1], Xiane Xiao[1], Jian Gao[1], Lulu Pan[1], Zihai He[1], Jinhong Yu[1,2]*

[1]*Key Laboratory of New Processing Technology for Nonferrous Metals and Materials, Ministry of Education, School of Material Science and Engineering, Guilin University of Technology, Guilin 541004, China.*

[2]*Key Laboratory of Marine Materials and Related Technologies, Zhejiang Key Laboratory of Marine Materials and Protective Technologies, Ningbo Institute of Materials Technology and Engineering, Chinese Academy of Sciences, Ningbo 315201, P.R. China*

**Corresponding author. E-mail address: lushaor@163.com (S.R. Lu)*

E-mail address: yujinhong@nimte.ac.cn (J.H. Yu)

SUPPLEMENT

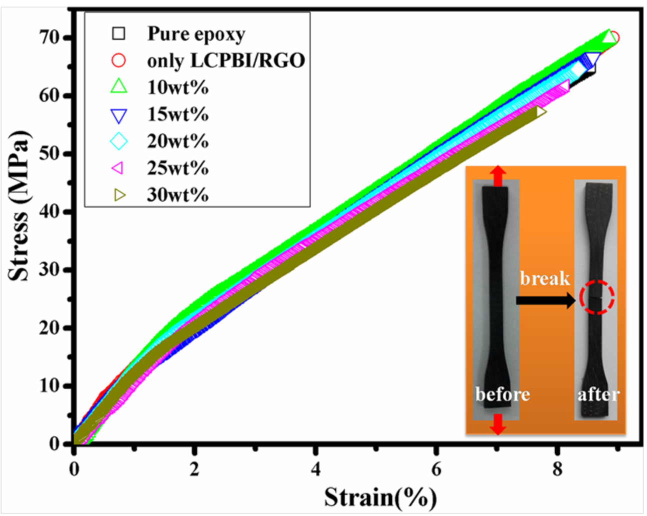

Figure S1 Typical tensile stress–strain curves for pure epoxy and its composites. The inset is 10 wt% LCPBI/RGO/Al_2O_3-APS/epoxy composites.

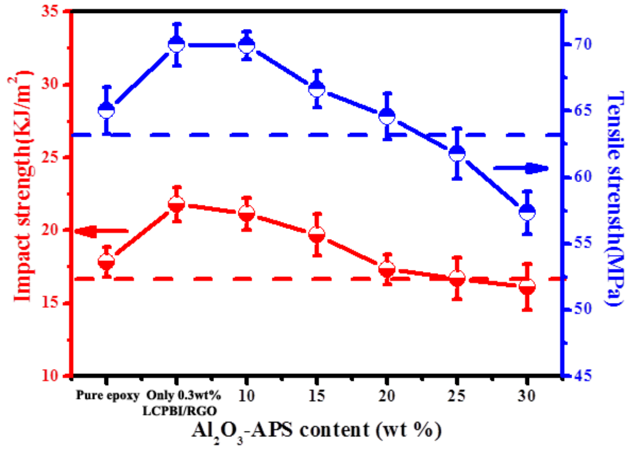

Figure S2 Impact strength and tensile strength of pure epoxy and its composites.

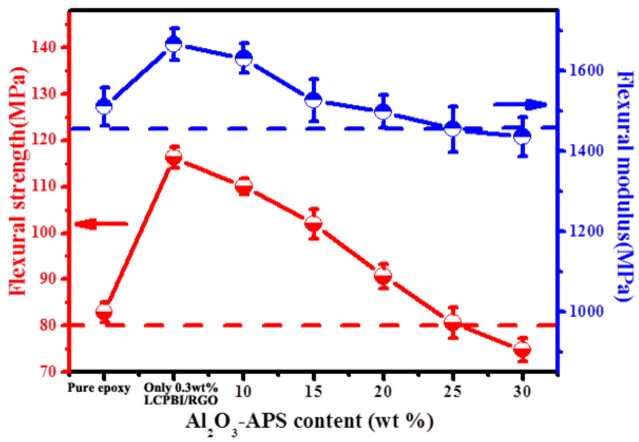

Figure S3 Flexural strength and modulus of pure epoxy and its composites.

Table S1 The mechanical properties of the pure epoxy and its composites.

Filler content (wt%)	Impact strength (kJ/m^2)	Tensile Strength (MPa)	Flexural strength (MPa)	Flexural modulus (MPa)
Pure epoxy	17.83±1.82	65.01±2.06	82.93±2.21	1511±47
0.3 wt% LCPBI/RGO	21.79±1.17	70.00±1.56	116.39±2.25	1667±40
10	21.14±1.09	69.94±1.07	110.07±1.69	1631±37
15	19.68±1.41	66.64±1.39	101.95±3.21	1527±53
20	17.33±1.03	64.59±1.74	90.63±2.61	1498±41
25	16.69±1.43	61.79±1.91	80.63±3.22	1455±56
30	16.12±1.57	57.34±1.61	74.78±2.58	1436±48

Typical stress–strain curves of the epoxy composites obtained during tensile testing are shown in **Figure S1**. From the stress-strain curves we observed that the materials extended in an almost linear fashion right up to their points of fracture without plastic deformation. **Figure S2** and **Figure S3** show the impact, tensile, and flexural properties of pure epoxy and its composites with the different filler loading, respectively. **Table S1** summarized the mechanical properties data. As we can see, the mechanical properties of composite with only 0.3 wt% LCPBI/RGO, as well as those composites with hybrid filler in lower content (less than 20 wt%), were improved compared with that of pure epoxy. The improvement may own to the LCPBI/RGO nanosheets. On the one hand, the load could efficiently transfer from the epoxy matrix to the nanosheets due to the strong interfacial adhesion between LCPBI/RGO nanosheets and epoxy matrix. On the other hand, the rigid molecules (RGO and PDI) and flexible molecular chain (PEG) of LCPBI/RGO embedded in epoxy resin and formed organic three-dimensional cross-linked network structure, enhancing the cross-linking density of composites. When material bore loads, the rigid segments of LCPBI/RGO produced a lot of cracks, absorbed the energy and improved the mechanical properties of the epoxy composites. When the hybrid filler content over 20 wt%, the mechanical properties of the composite decreased and lower than that of pure epoxy. This is because when the hybrid filler loading exceeded the critical level, those Al_2O_3-APS nanoparticle will play a leading role. The nanoparticle may easily agglomerate in the composites, lead to a defect area in the matrix and a decline in its mechanical properties.