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Supporting Information

Surface Modification and Magnetic Alignment of Hexagonal Boron Nitride Nanosheets for High Thermally Conductive Composites

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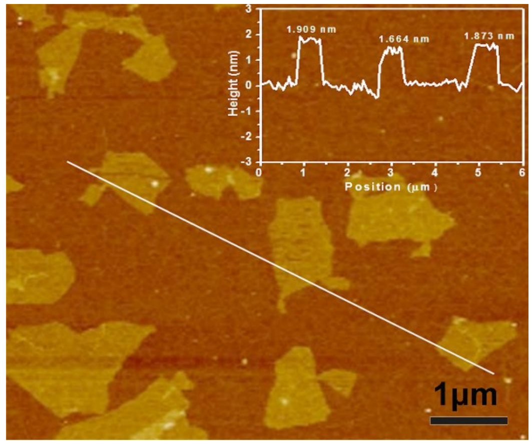

Fig. S1. AFM image and height profiles of BNNSs.

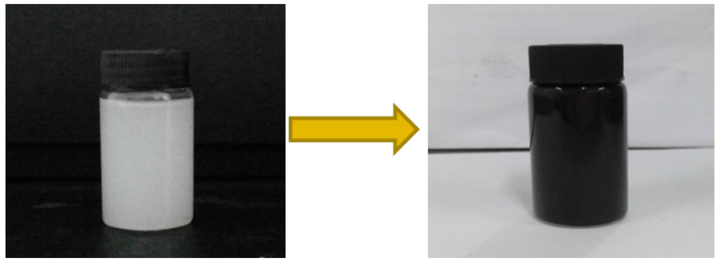

Fig. S2. Photographs of BNNSs (left) and mBNNSs (right) dispersed in water.

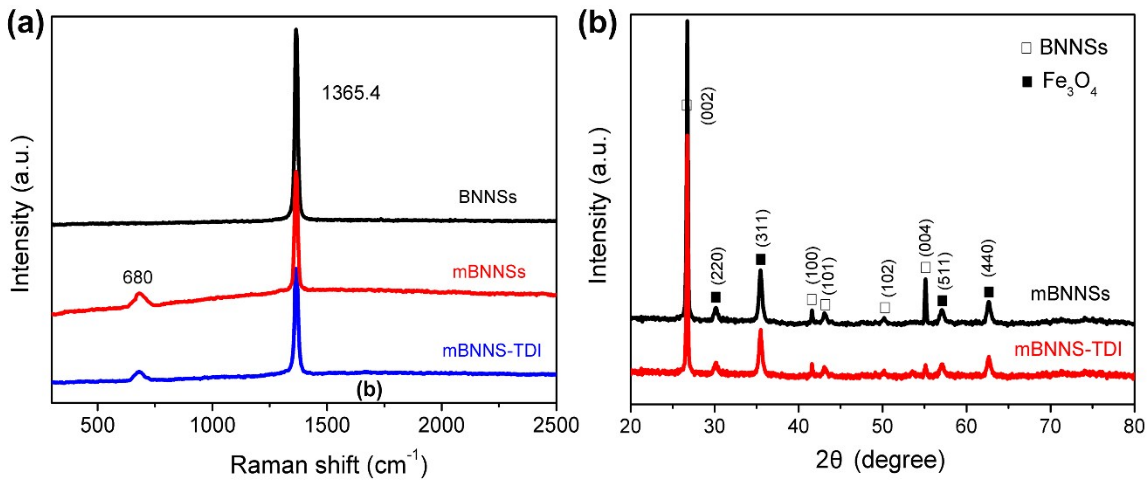

Fig. S3 (a) Raman spectra of BNNSs, mBNNSs and mBNNS-TDI. (b) XRD patterns of mBNNSs and mBNNS-TDI, the hollow labels refer to diffraction peaks from BNNSs, and the solid labels refer to peaks from Fe_3O_4 nanoparticles.

$$T_m = 2\pi\mu_o\chi_\alpha^2[(h+d)(l+d)^2 - hl^2]H_m^2 sin^2\theta/3(\chi_\alpha + 1) \quad \text{(S1)}$$

where μ_o the magnetic permeability of free space ($4\pi \times 10^{-7}$ Hm^{-1}), χ_α is the magnetic susceptibility of mBNNS-TDI, h and l are the half of the thickness and diameter of mBNNS-TDI, d is the particle size of Fe_3O_4, θ is the angle between mBNNS-TDI long axis and the magnetic vector.

$$T_g = 2\pi hl^2(\rho_f + \rho_m)glcos\theta \quad \text{(S2)}$$

where ρ_f and ρ_m are the density of mBNNS-TDI and TPU matrix, respectively, g is a constant.

$$T_v = 12\pi\eta hl^2(d\phi/dt)(f/f_o)$$

where, $f/f_o = 4(1-\delta^2)/[3(2-hR\delta^2]$,

$$R = (2/h)(\delta^2-1)^{-1/2}tan^{-1}[(\delta^2-1)^{1/2}] \quad \text{(S3)}$$

where η is the viscosity of resin, $d\phi/dt$ is the angular frequency of mBNNS-TDI, δ is the aspect ratio of mBNNS-TDI.

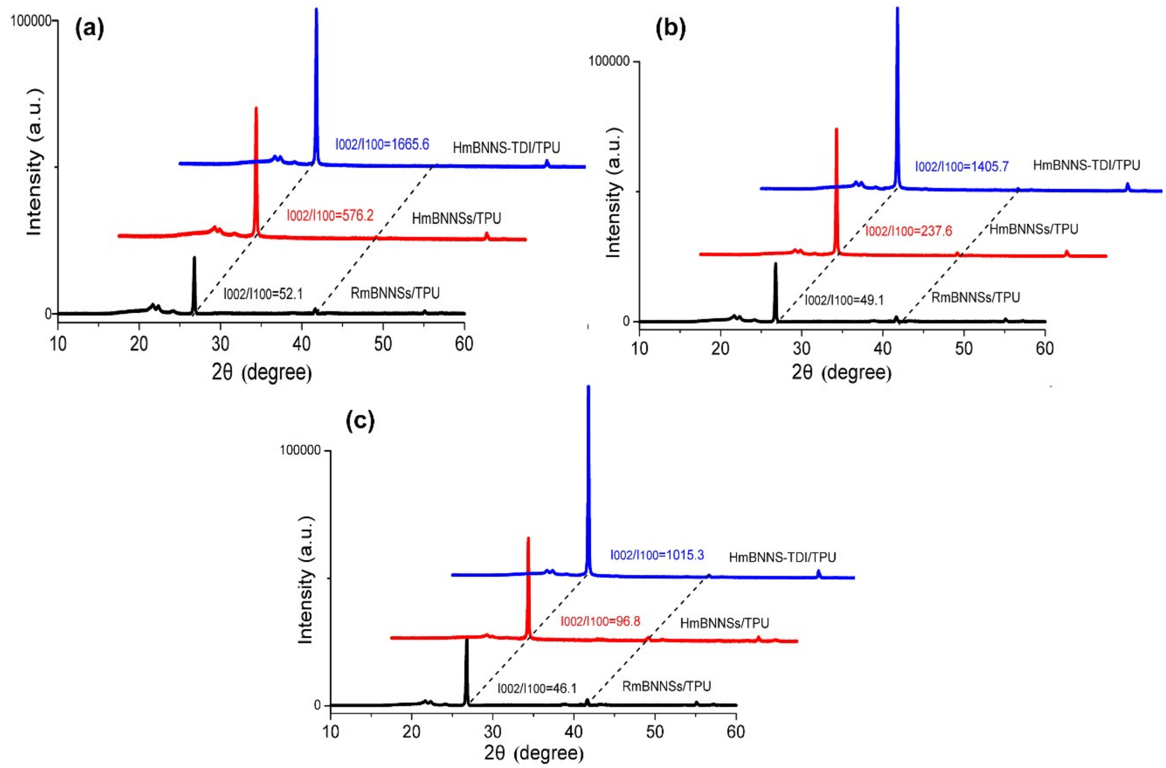

Fig. S4 XRD patterns of different composites with (a) 5 wt% fillers, (b) 20 wt% fillers, (c) 30 wt% fillers.

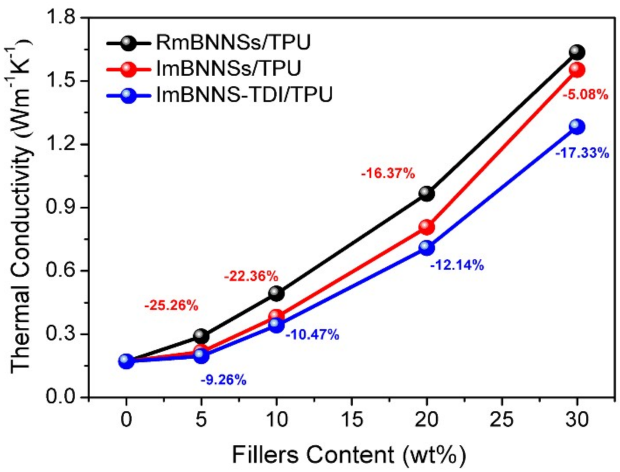

Fig.S5 Through-plane thermal conductivities of RmBNNSs/TPU, ImBNNSs/TPU and ImBNNS-TDI/TPU composites. The red numbers show the through-plane thermal conductivity enhancement of ImBNNSs/TPU in comparison with the RmBNNSs/TPU composites. The blue numbers show the through-plane thermal conductivity enhancement of ImBNNS-TDI /TPU in comparison with the ImBNNSs/TPU composites.

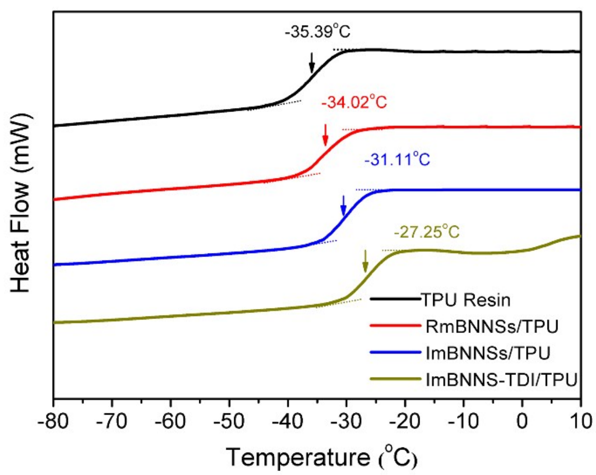

Fig. S6 DSC curves of TPU resin and various composites with 10 wt% loading.

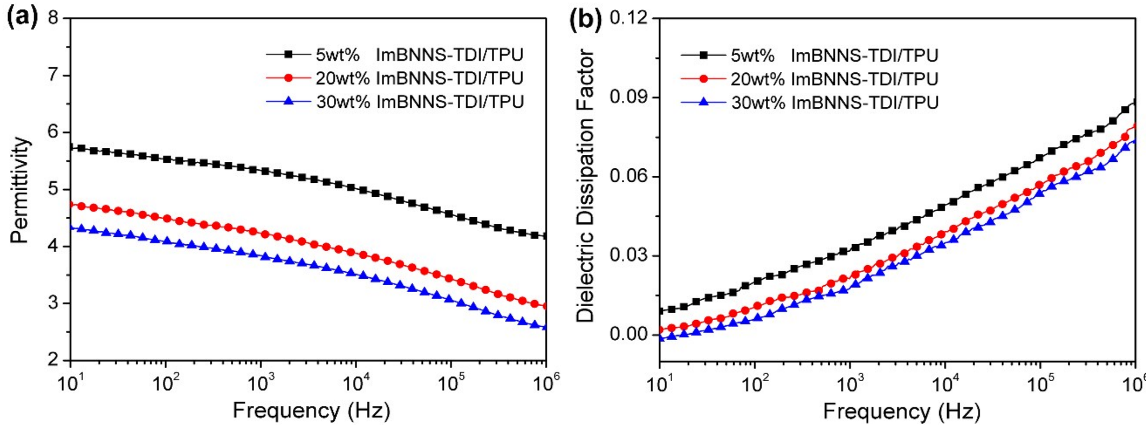

Fig. S7 Frequency dependence of dielectric constant (a) and dielectric dissipation factor (b) of ImBNNS-TDI/TPU composites with various filler loadings.