Supporting Materials for

Polypyrrole Doped Epoxy Resin Nanocomposites with Enhanced Mechanical Properties and Reduced Flammability

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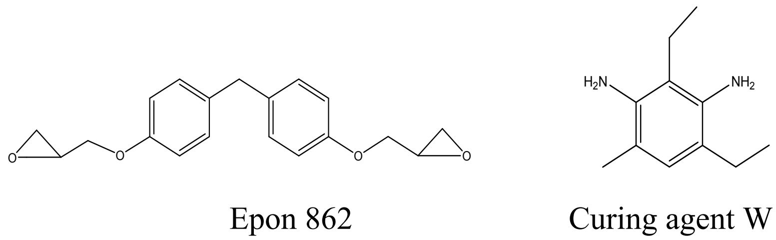

Scheme 1. Molecular structure of Epon 862 and the used curing agent Epicure W.

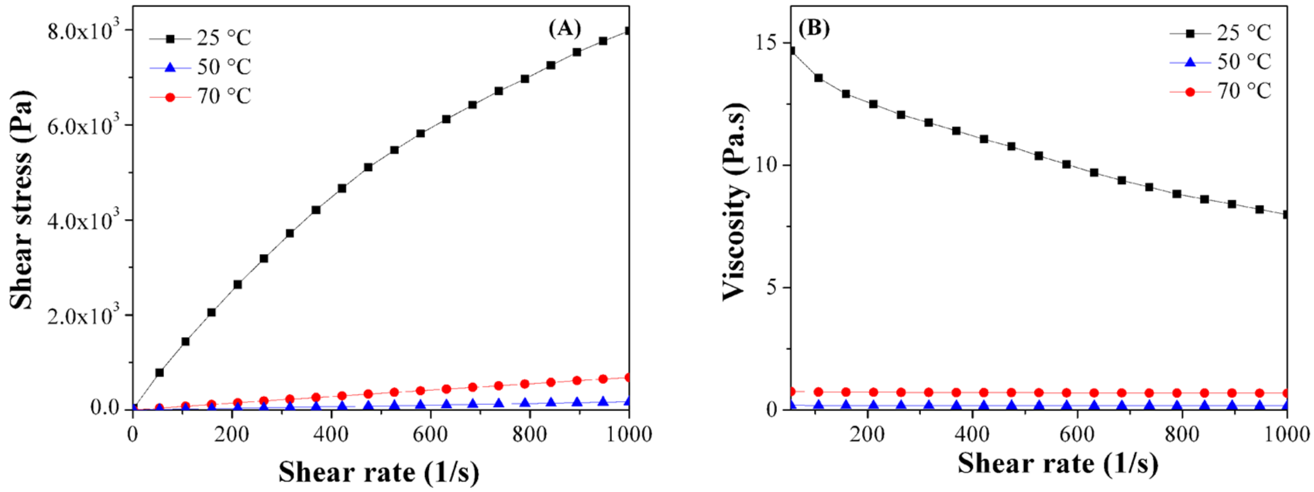

Fig. S1 (A) Shear stress and (B) viscosity vs. shear rate of the epoxy nanosuspensions with 10.0 wt% PPy nanospheres at different test temperatures.

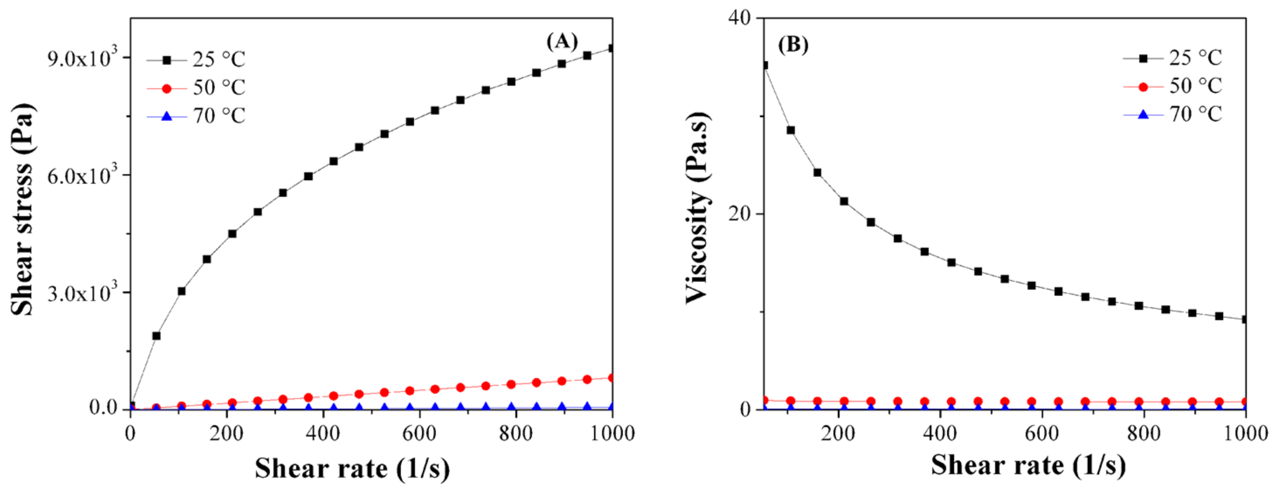

Fig. S2 (A) Shear stress and (B) viscosity vs. shear rate of the epoxy nanosuspensions with 10.0 wt% PPy nanofibers at different test temperatures.

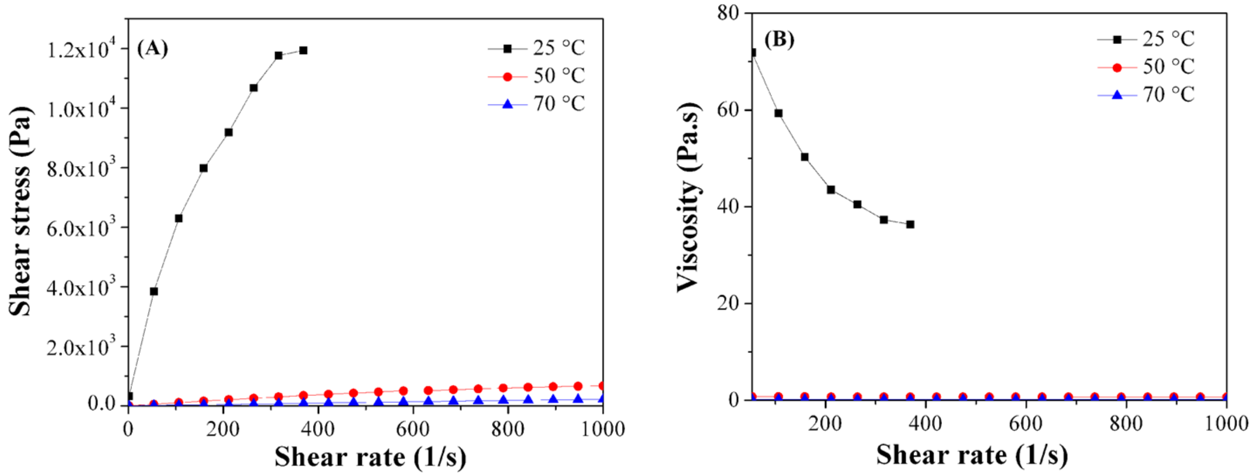

Fig. S3 (A) Shear stress and (B) viscosity vs. shear rate of epoxy nanosuspensions with 20.0 wt% PPy nanofibers at different test temperature.

The rheological behavior of the epoxy resin nanosuspension with 20.0 wt% PPy nanofibers was only investigated at shear rates ranging from 1 to 400 1/s at 25 °C, Fig. S3(A), because the shear stress value becomes over the limit of the rheometer at higher shear rate.

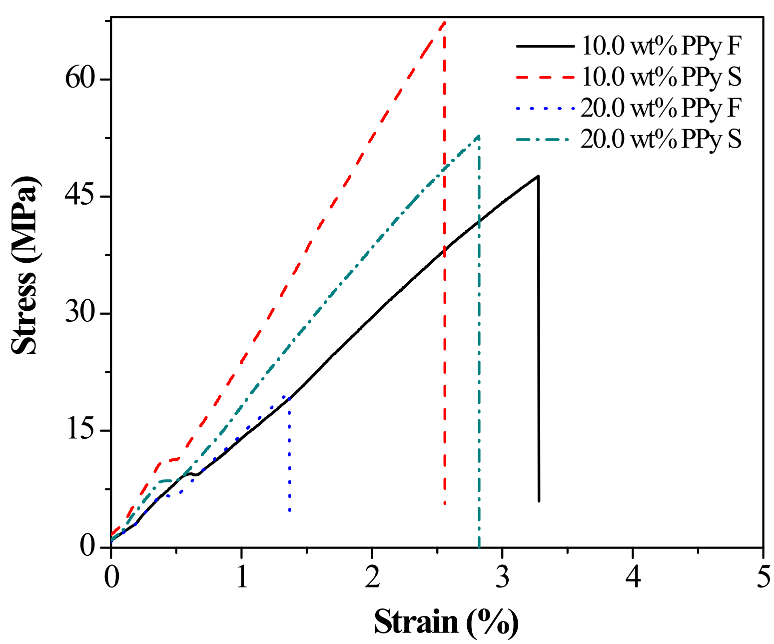

Fig. S4 Stress–strain curves of cured epoxy nanocomposites filled with different PPy nanoparticle loadings.

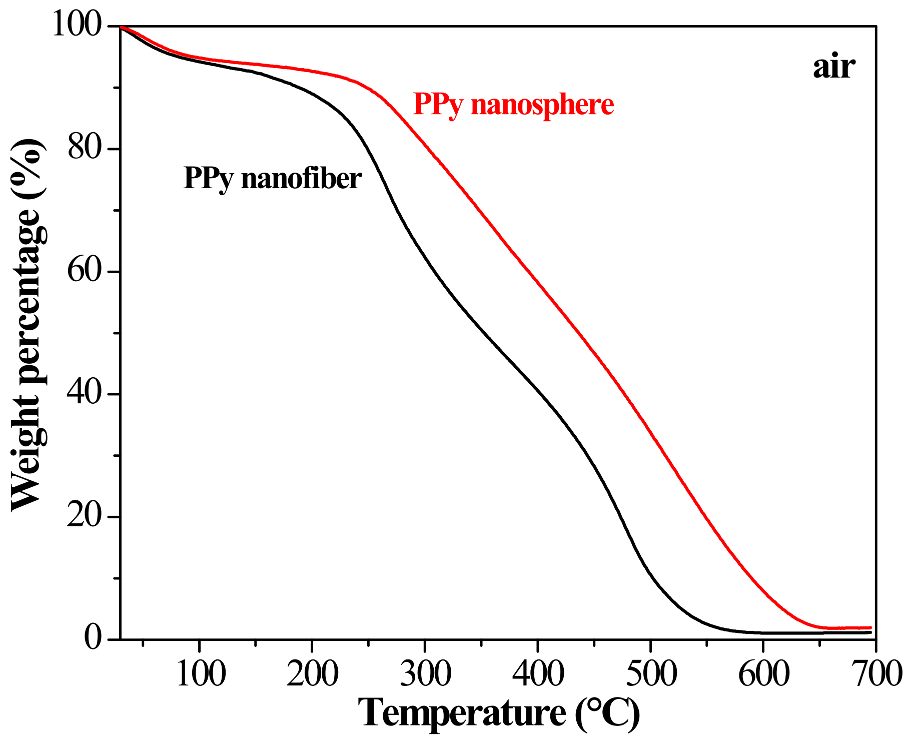

Fig. S5 TGA curves of the PPy nanofibers and nanospheres.

The PPy nanospheres have a better thermal stability than the nanofibers in air condition. Both PPy nanofillers show a slight weight loss stage from room temperature to 150 °C, which is attributed to the release of moisture and organic solvent residue entangled in the polymer chains. The main weight loss stage for the PPy nanofiller is associated with the degradation of the polymer backbone, and the decomposition temperature of the PPy nanofibers (200.78 °C) is lower than that of the PPy nanospheres (213.63 °C).

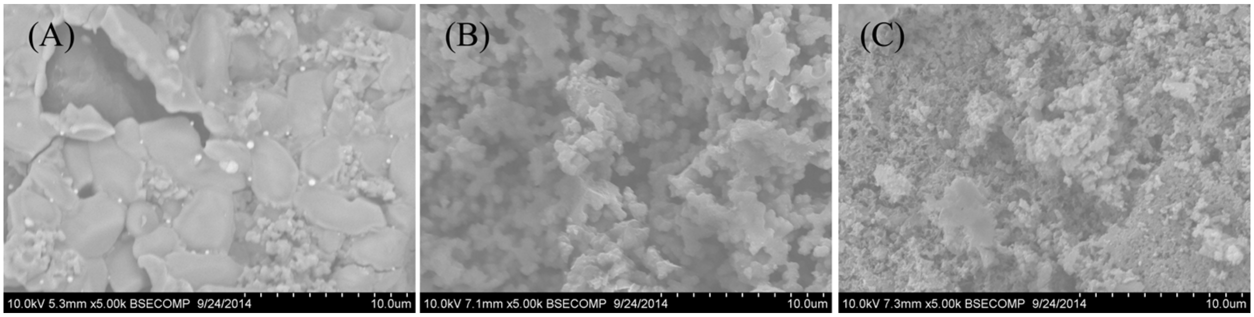

Fig. S6 The SEM images of the residue of (A) the cured pure epoxy and its PNCs with 20.0 wt% PPy (B) the nanospheres and (C) the nanofibers.

The microscopy of the char layer of pure epoxy and the nanocomposites with PPy nanostructures was evaluated by using scanning electron microscopy (Hitachi S-3400 scanning electron microscopy). Due to the limited amount of samples collected (less than 1 mg) after the MCC test, the SEM test was run on the samples prepared with the TGA test. Specifically, the samples were heated in nitrogen from room temperature to 900 °C with a heating rate of 10 °C/min, and the test procedures were specially designed to simulate the flammability test. From the SEM, it can be observed that only a thin char layer was formed for the processed pure cured epoxy resin, Fig. S6(A). However, for the nanocomposites prepared with PPy nanospheres and nanofibers, Fig. S6(B&C), the morphology of the char layer is quite different, a continued char structure was observed, indicating that the PPy nanostructures promoted the char yield of the epoxy resin.