Supporting Information

for *Macromol. Chem. Phys.,* DOI: 10.1002/macp.201400443

In Situ Polymerized pCBT Composites with Aligned Carbon Nanotube Buckypaper: Structure and Properties

Zhongrui Li,* Rebekah Downes, Zhiyong Liang

Supporting Information

For *Macromol. Chem. Phys.*, DOI: 10.1002/macp.201400443

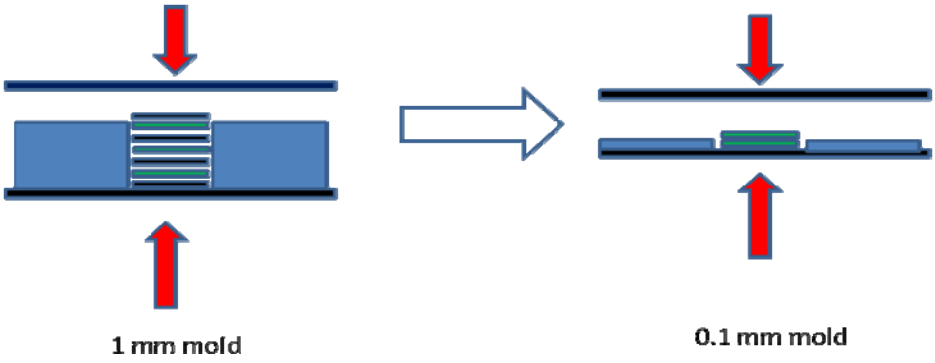
In Situ Polymerized pCBT Composites with Aligned Carbon Nanotube Buckypaper: Structure and properties

Zhongrui Li,*[†‡] Rebekah Downes,[‡] Zhiyong Liang[‡]

Electron Microbeam Analysis Laboratory (EMAL), University of Michigan, MI 48109, High Performance Material Institute (HPMI), Florida State University, FL 32310.

KEYWORDS: in situ polymerization, cyclic butylene terephthalate, thermoplastic

3.4 *Comparison with buckypaper/ pCBT composites made through stacking approach*



Scheme S1. Schematic diagram for the preparation of laminate structure pCBT/BUCKYPAPER composites.

For comparison, we also prepared *buckypaper/pCBT* composites through stacking approach, similar as that described in reference.[i] The as-received CBT-160 powders were first hot pressed into 0.1mm thick strips at 250 ^{o}C using a 10-ton hydraulic Carver press (Wabash, Indiana, U.S.A.). Steel shim stock was used as a mold to produce the pCBT strips. Poly(butylene terephthalate) (PBT) is an important semicrystalline engineering thermoplastic with many valuable properties including a high rate of crystallization, good solvent resistance, thermal

stability, and excellent processing properties. However, pure PBT has low impact strength and heat distortion temperature. The buckypaper and pCBT films were carefully laid up in various laminate configurations, as shown in Scheme S1. Individual *buckypaper/pCBT* laminates were then subjected to a pressure of approximately 14 MPa at 250°C for 30 minutes, and then allowed to cool to room temperature. The weight fraction of buckypaper in each composite sample was calculated using the weight of the buckypaper divided by the total mass of the final composite samples, as shown in Table S1.

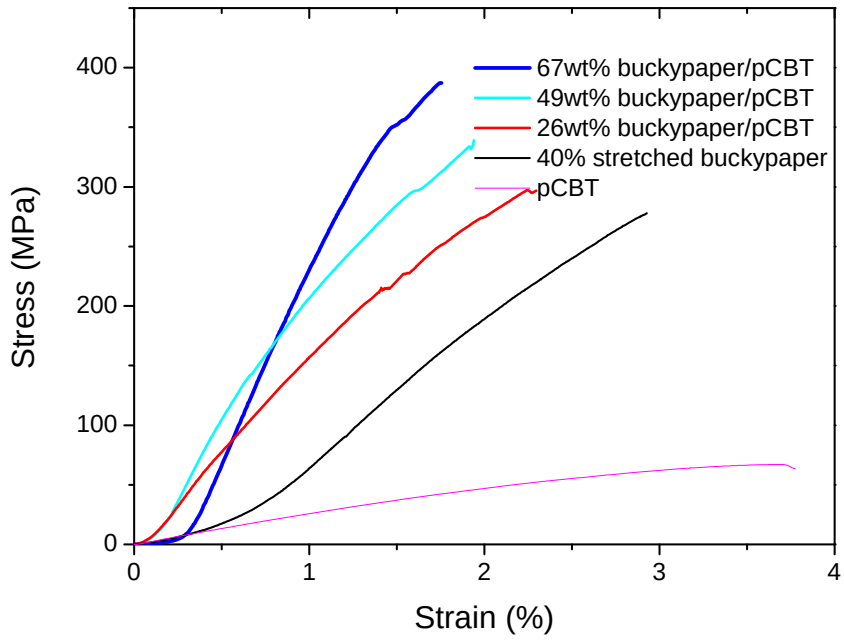


Figure S1. The typical uniaxial tensile stress–strain curves of the 40%-stretched buckypaper/pCBT composites fabricated using stacking approach. The mechanical properties of the 40%-stretched buckypaper and the neat pCBT are also included for comparison.

Table S1. Mechanical performances of the buckypaper/pCBT composites fabricated using stacking approach. The mechanical properties of the 40%-stretched buckypaper and the neat pCBT are also included for comparison.

Sample Name	**Young's Modulus (GPa)**	**Tensile Strength (MPa)**	**Elongation at Break (%)**	**Density (g/cm^3)**
pCBT	2.4±0.5	67±11	3.8±0.6	1.30±0.05
26wt% *buckypaper*/pCBT	15.9±2.4	297±45	2.3±0.4	2.26±0.05

49wt% *buckypaper*/pCBT	25.5±3.9	339±51	1.9±0.3	2.19±0.05
67wt% *buckypaper*/pCBT	33.2±3.9	387±58	1.8±2	1.85±0.05
~40% stretched *buckypaper*	13.2±1.9	278±42	2.9±0.5	0.85±0.05

The strain-stress curves and the tensile properties of the buckypaper/pCBT composites made via stacking approach were displayed in Figure S1 and listed in Table S1, respectively. The buckypaper concentration increases with increasing stacking layers, since the thickness of mold is set, when more tacking layers were added into the mold, the more pCBT resin will be squeezed out, accordingly increasing the buckypaper content in the final composites. Similar to the buckypaper/pCBT composites synthesized through in situ polymerization approach, the tensile strength was enhanced by incorporating buckypaper into pCBT. But the in-situ polymerized composites exhibit better mechanical performance as compared to the counterparts with the same buckypaper content which were made through stacking method (Table 1). It can be understood from the fact that solution based polymerization can guarantee uniform dispersion of CBT molecules on the wall surfaces of CNTs (Figure S2), as a consequence, leading to better interface interaction between pCBT and CNT.

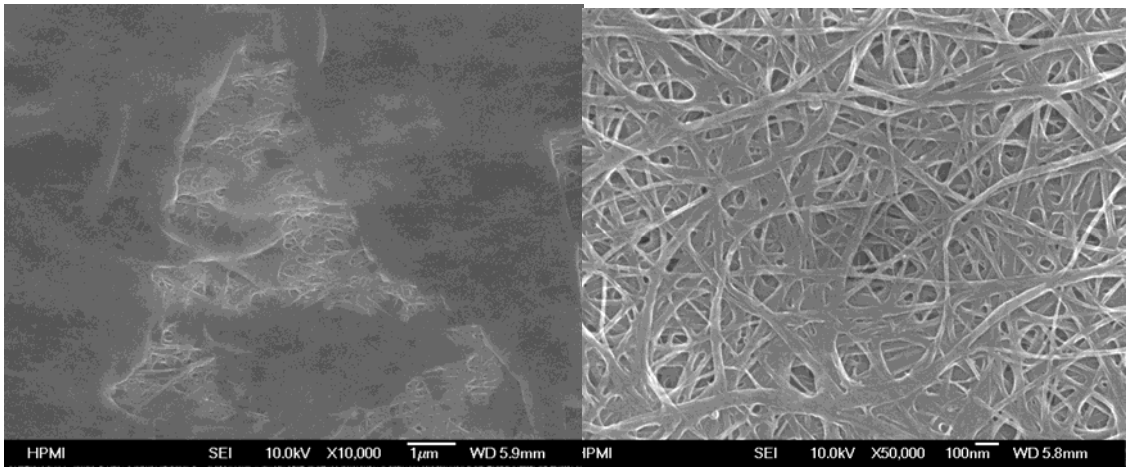


Figure S2. Comparison of the surface morphology of buckypaper/ pCBT composites fabrication through different approaches: (left) stacking vs. (right) wetting methods.

[i] Chang, C.-Y.; Phillips, E. M.; Liang, R.; Tozer, S. W.; Wang, B.; Zhang, C.; Chiu, H.-T. *J. Appl. Polym. Sci.* **2013**, 128(3), 1360–1368.