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Mechanical reinforcement of PBO fibers by dicarboxylic acid functionalized carbon nanotubes through *in situ* copolymerization

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Table S1 Research on the viscosity of PBO and CNTs I-III & PBO copolymer fibers.

Sample fibers	$[\eta]$ (dL·g^{-1})	M_v (g·mol^{-1})
PBO	8.9	1.48× 10^4
CNTs I & PBO	12.0	1.66 × 10^4
CNTs II & PBO	12.5	1.69× 10^4
CNTs III & PBO	13.8	1.79 × 10^4

$$E_p = E_m \left[\frac{1+2(l_{NT}/d_{NT})\eta_P V_{NT}}{1-\eta_P V_{NT}} \right] \quad (1)$$

$$E_c = E_m \left[\frac{3}{8}\frac{1+2(l_{NT}/d_{NT})\eta_L V_{NT}}{1-\eta_L V_{NT}} + \frac{5}{8}\frac{1+2\eta_U V_{NT}}{1-2\eta_U V_{NT}} \right] \quad (2)$$

where in (1) $\eta_P = \dfrac{(E_{NT}/E_m)-1}{(E_{NT}/E_m)+2(l_{NT}/d_{NT})}$,

in (2) $\eta_L = \dfrac{(E_{NT}/E_m)-1}{(E_{NT}/E_m)+2(l_{NT}/d_{NT})}$ and $\eta_U = \dfrac{(E_{NT}/E_m)-1}{(E_{NT}/E_m)+2}$.

In the above equations, *Ep* is the tensile modulus of the composites with CNTs aligned along axial direction of the fiber, E_c is the tensile modulus of the composite fiber with randomly distributed CNTs, E_m is the tensile modulus of PBO matrix, E_{NT} is tensile modulus (1 TPa) of CNTs bundle, l_{NT} and d_{NT} are average length (50 nm) and diameter (5 nm) of CNTs bundles, V_{NT} is the volume fraction of CNTs. The density for CNTs, PBO for calculation V_{NT} is 1.60, 1.54 g·cm^{-3}, respectively.

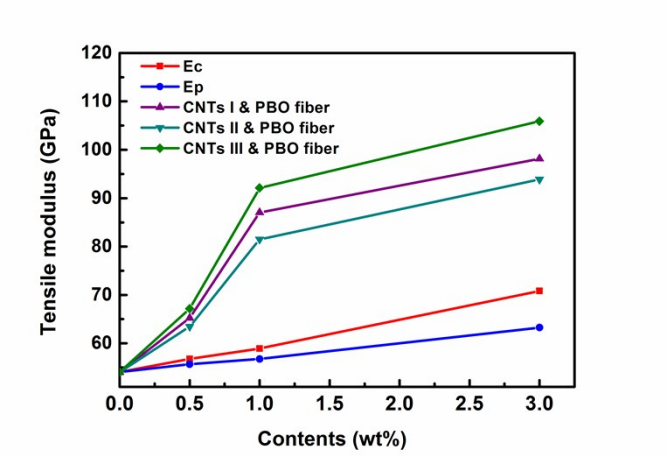

Fig.S1 Tensile modulus of CNTs I-III & PBO copolymer fibers compared with the prediction values