Supplementary Material (ESI) for Chemical Communications

Supporting Information

One-pot noncovalent method to functionalize multi-walled carbon nanotubes using cyclomatrix-type polyphosphazenes

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Experimental Materials

Hexachlorocyclotriphosphazene (HCCP) (Aldrich) was recrystallized from dry hexane followed by sublimation (60 ^{o}C, 0.05 mmHg) twice before use (mp = 112.5–113 ^{o}C). 4,4′-Sulfonyldiphenol (BPS) (purify >99.5%) was obtained from Jiangsu Alonda High-Tech Industry Co., Ltd. (Jiangsu, China) and used as received. Multi-walled carbon nanotubes (CNTs) were obtained from Tsinghua Nafine Nano-Powder Commercialization Engineering Centre (with an average diameter of about 11 nm and a purity of 98%). Tetrahydrofuran, ethanol and triethylamine (TEA) was purchased from Shanghai Chemical Reagents Corp. (Shanghai, China) and used without further purification.

Characterization

The FTIR measurements were conducted on a Perkin-Elmer Paragon 1000 Fourier transform spectrometer at room temperature. SEM measurement was carried out with a JEOL JSM-7401F field-emission microscopy. SEM samples were diluted 20 times with ethanol and then deposited on glass substrates. Transmission electron microscopy (TEM) and energy-dispersive X-ray spectroscopy (EDX) were performed

with a JEOL JEM-2010 microscope operated at 100 kV. The X-ray diffraction (XRD) pattern was recorded on a powder sample using a Bruker D8 Advance instrument with Cu Kα radiation at a scanning rate of 6 degrees per minute in 2θ ranging from 10 to 60º. Elemental analyses were performed using a Perkin Elmer 2400-II.

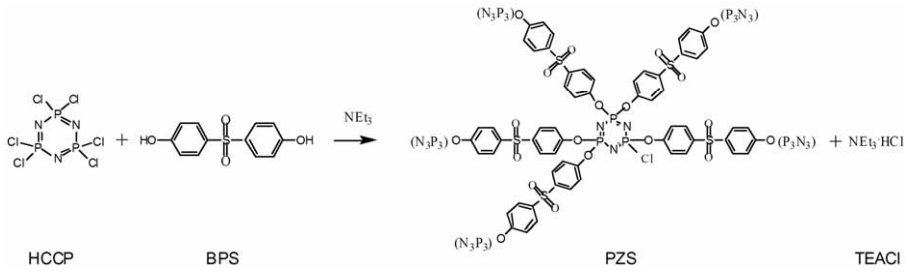

Fig. S1. The polycondensation of comonomers HCCP and BPS and the organic-inorganic hybrid cross-linked structure of the PZS product as shell of nanocables. (P_3N_3) indicates other phosphazene cores.

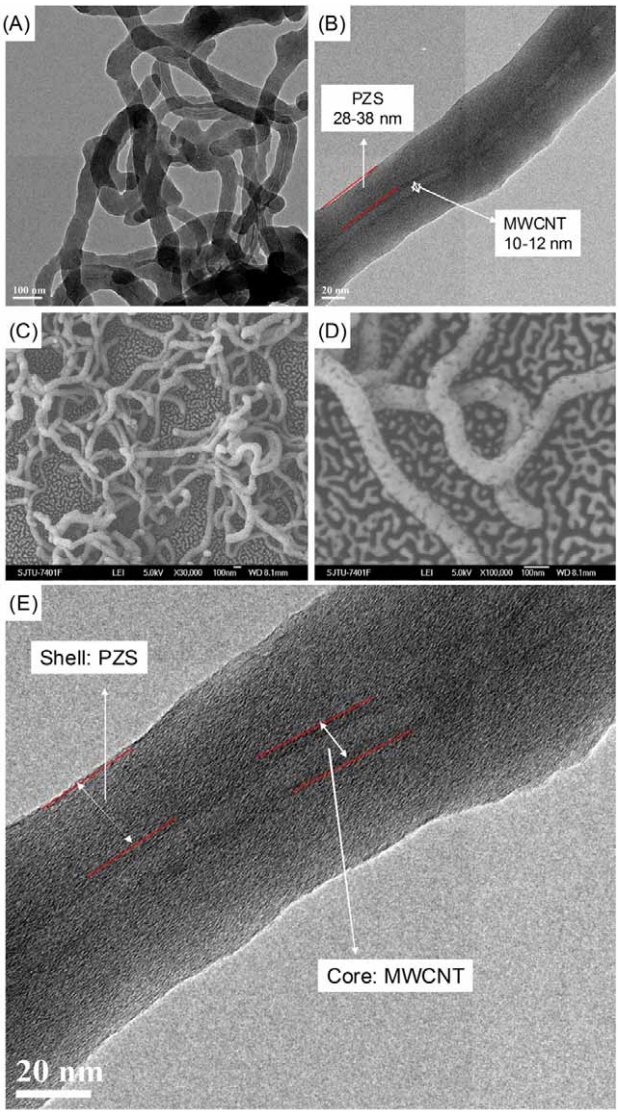

Fig. S2 Typical TEM (A, B) and SEM (C, D) images of the MWCNT/PZS nanocables prepared at the mass ratio of MWCNT: HCCP: BPS=1: 10: 24. By controlling the ratio, we could easily tune the shell thickness of nanocables. (E) A magnified TEM image which shows a typical core/shell structure of MWCNT/PZS nanocable, and the relatively darker layers are the graphite sheets of MWCNTs.

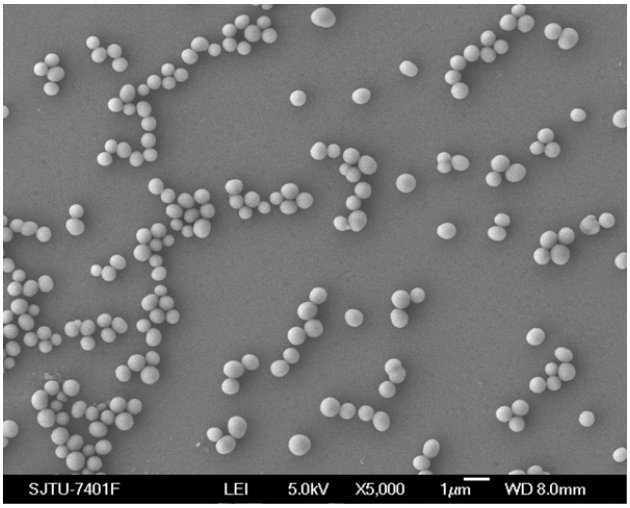

Fig. S3 SEM image of PZS microspheres obtained in the absence of MWCNTs.