

Supporting Information

Modification of multi-walled carbon nanotubes with cobalt phthalocyanine: Effects of the templates on the assemblies

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1. Materials

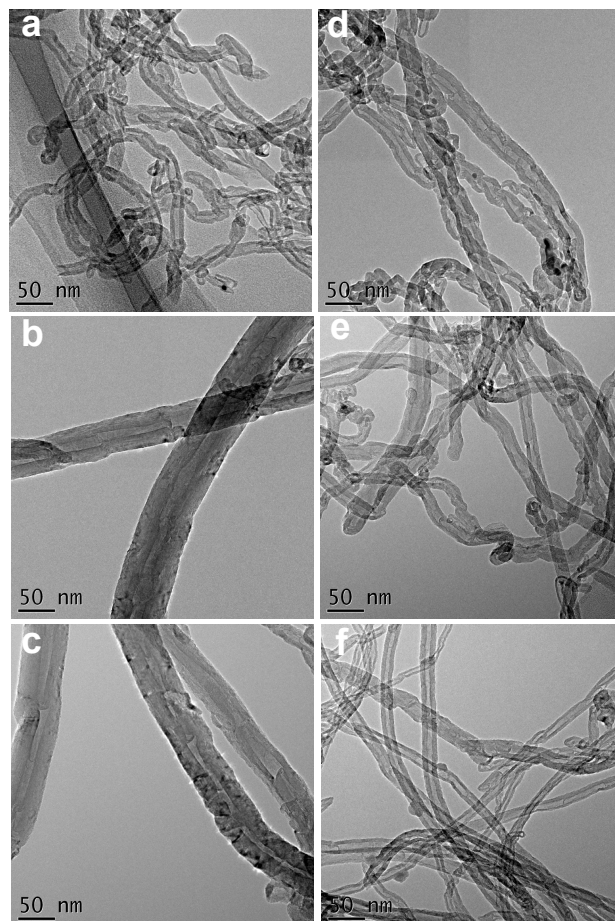


Fig. S1 TEM images of MWCNTs used as templates. a, TEM image of Conventional MWCNTs with ~ 20 nm in outer diameter. b-f, TEM images of AF-MWCNTs with approximately ~ 50 , ~ 40 , ~ 30 , ~ 20 and ~ 10 nm in OD, respectively.

Conventional MWCNTs (>95 wt %) and five kinds of acid functionalized MWCNTs (>95 wt %) were obtained from Chengdu Organic Chemical Co, Ltd., Chinese Academy of Sciences, the typical diameter and length of MWCNT were

confirmed using transmission electron microscopy (TEM) with ~20, ~50, ~40, ~30, ~20 and ~10nm in in outer diameter (OD), respectively (shown in Fig. S1).

Table S1. The characteristics of MWCNTs using as templates

MWCNT templates	1	2	3	4	5	6
OD(nm)	~20	~50	~40	~30	~20	~10
SSA (m ² g ⁻¹)	~200	~40	~60	~110	~200	~233
-COOH Content (%)	–	0.49	0.73	1.23	2.00	2.56

2. Characterization of CoPc/MWCNTs assemblies

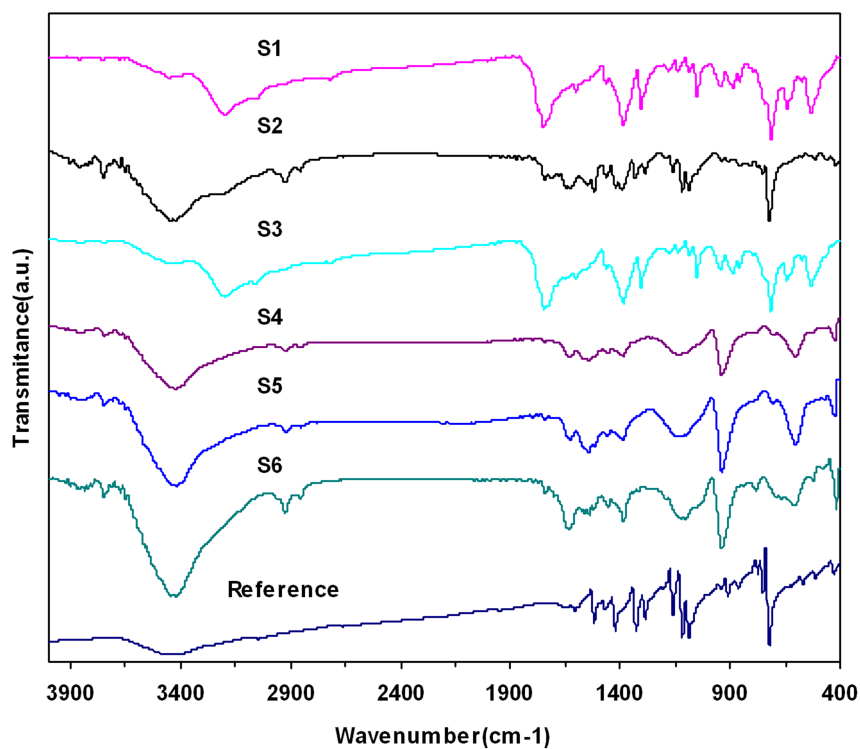


Fig. S2 IR spectra of CoPc/MWCNTs synthesized by using MWCNTs as templates.

The IR spectra of CoPc/MWCNTs assemblies S1, S2, S3, S4, S5, S6 and reference CoPc are shown in Fig. S2. The spectra of CoPc/MWCNTs show that the typical bands for are assigned to the Co-N band in the $911\text{-}925\text{ cm}^{-1}$ region, and strong peak is assigned to the backbone of CoPc in the $722\text{-}738\text{ cm}^{-1}$ region. The spectra of CoPc/MWCNTs also show other bands corresponding to those displayed by CoPc.



Fig. S3 SEM image of MWCNT-templated assemblies S1.

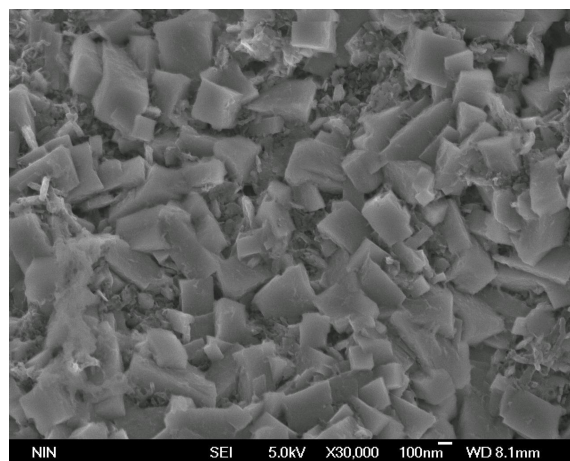


Fig. S4 SEM images of MWCNT-templated assemblies S3.

The assemblies of S1 consist of CoPc nanothreads linked by conventional MWCNTs, around 100-200 nm in each sides of cross section and the length of the assemblies is about several millimeters (as shown Fig. S3). The assemblies of S3 consist of nano crystal CoPc with approximate 80-100 nm in size, linked by AF-MWCNTs, exhibit uniform morphology (as shown Fig. S4).

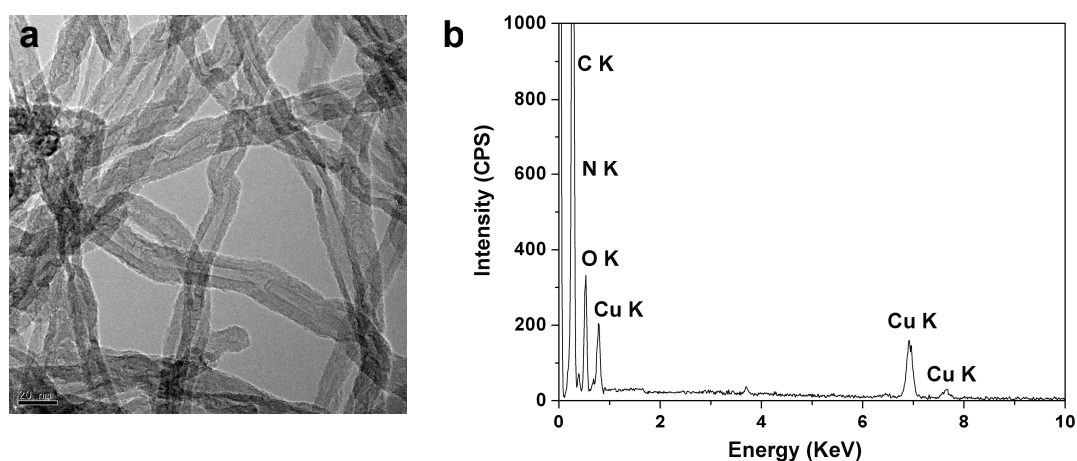


Fig. S5 (a) TEM of the remainder, showing no CoPc inside MWCNTs. (b) EDS spectrum of the remainder, showing only carbon element and oxygen detected besides the Cu which comes from the copper grid.

To investigate the inside of the as-products, dimethylformamide (DMF) was used to remove CoPc formed outside the MWCNTs. EDS and TEM were used to characterize the remainder (shown in Fig. S5). EDS spectra display only carbon element and oxygen were detected besides the Cu which comes from the copper grid, so there existed no cobalt inside the MWCNTs. TEM image of the remainder shows

no materials inside the MWCNTs. In addition, it is impossible to remove CoPc formed inside CNTs by using organic solvent.¹ Therefore, it can be inferred that the structure of the as-received CoPc/MWCNTs is coaxial nanotube.

1 L. Cao, H. Z. Chen, H. Y. Li, H. B. Zhou, J. Z. Sun, X. B. Zhang and M. Wang, *Chem. Mater.* 2003, **15**, 3247–3249.
