

Supporting information for

Hierarchical carbon-nanotube/quartz-fiber films with gradient nanostructures for high efficiency and long service life air filters

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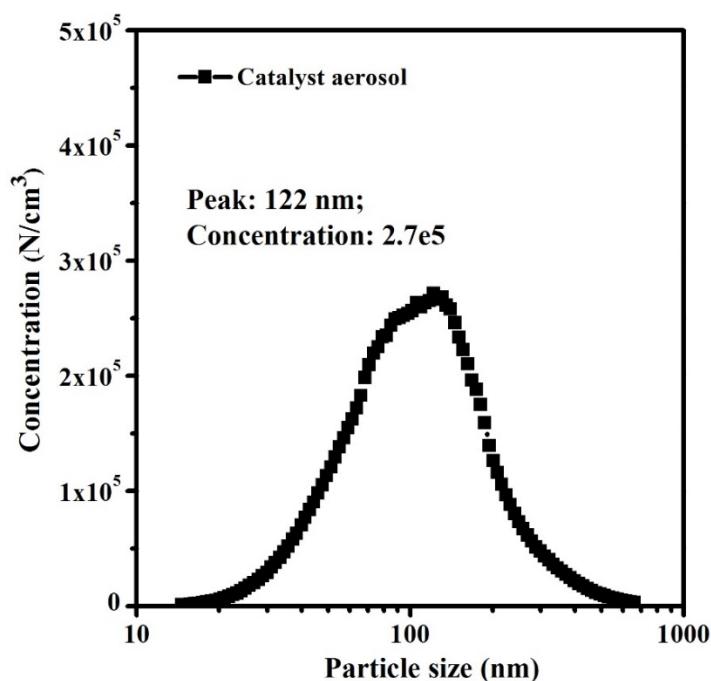


Fig. S1: Typical size distribution of atomized catalyst aerosols used for catalyst loading on quartz fiber (QF) filters.

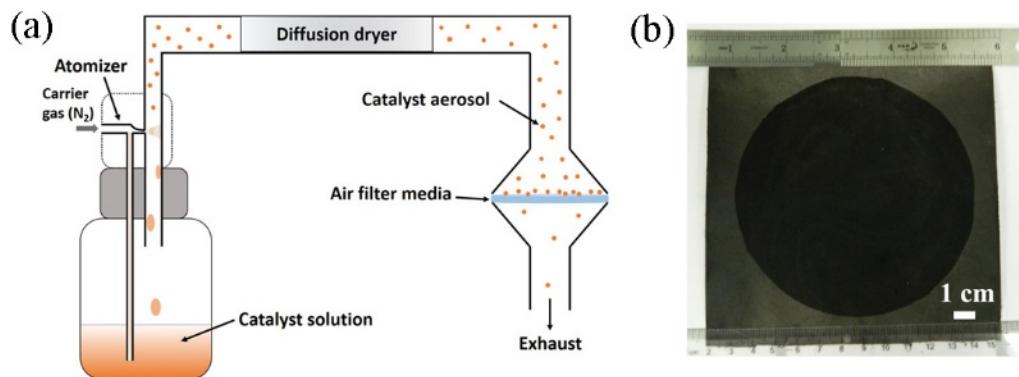


Fig. S2: (a) The schematic of the catalyst loading process of QF filter; (b) the digital photo of as-prepared CNT/QF filter.

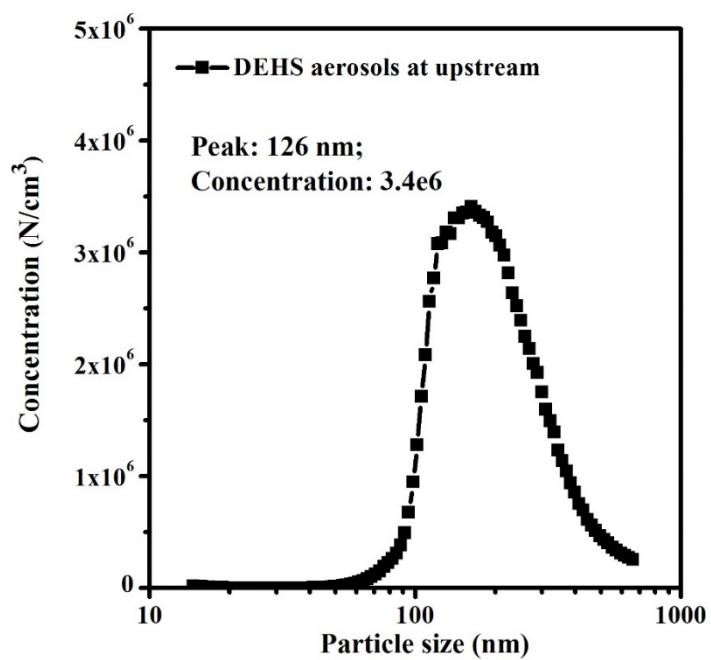


Fig. S3: Typical size distribution of atomized polydisperse DEHS aerosols used for air filtration test.

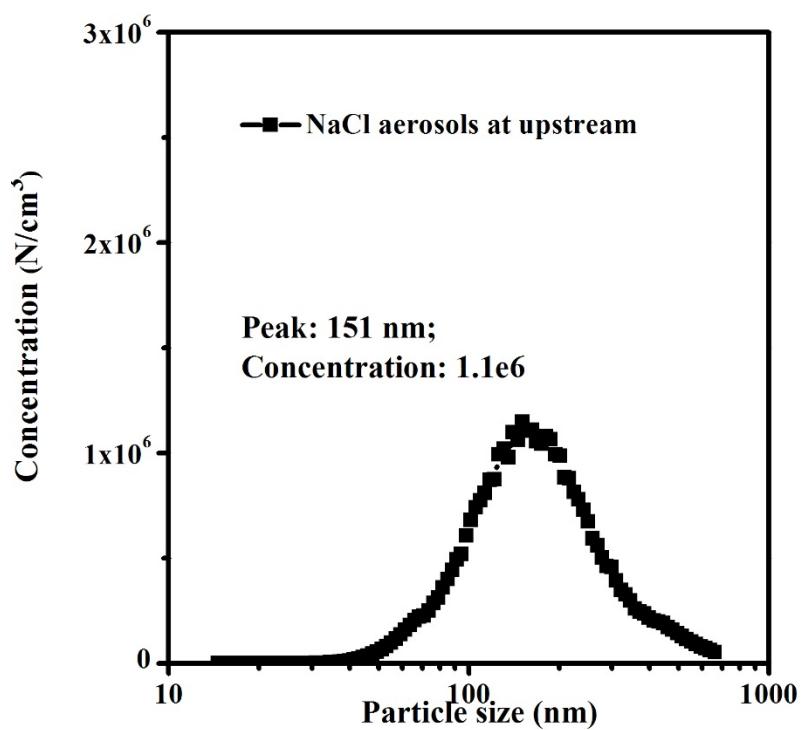


Fig. S4: Typical size distribution of atomized polydisperse NaCl aerosols used for loading on the CNT/QF filters and QF filters.

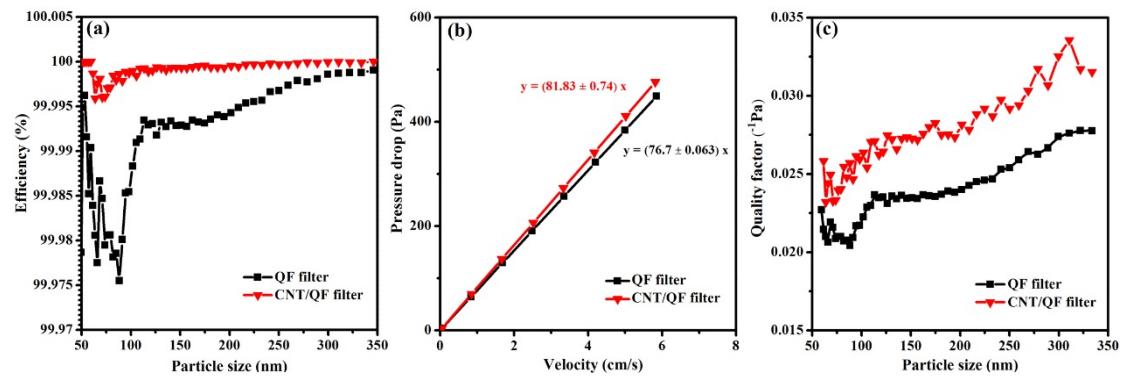


Fig. S5: (a) Pressure drop versus face velocity of the QF filter and the CNT/QF filter; (b) penetration of particles with difference sizes of the QF filter and the CNT/QF filter; (c) Q_f versus particle size of the QF filter and the CNT/QF filter.

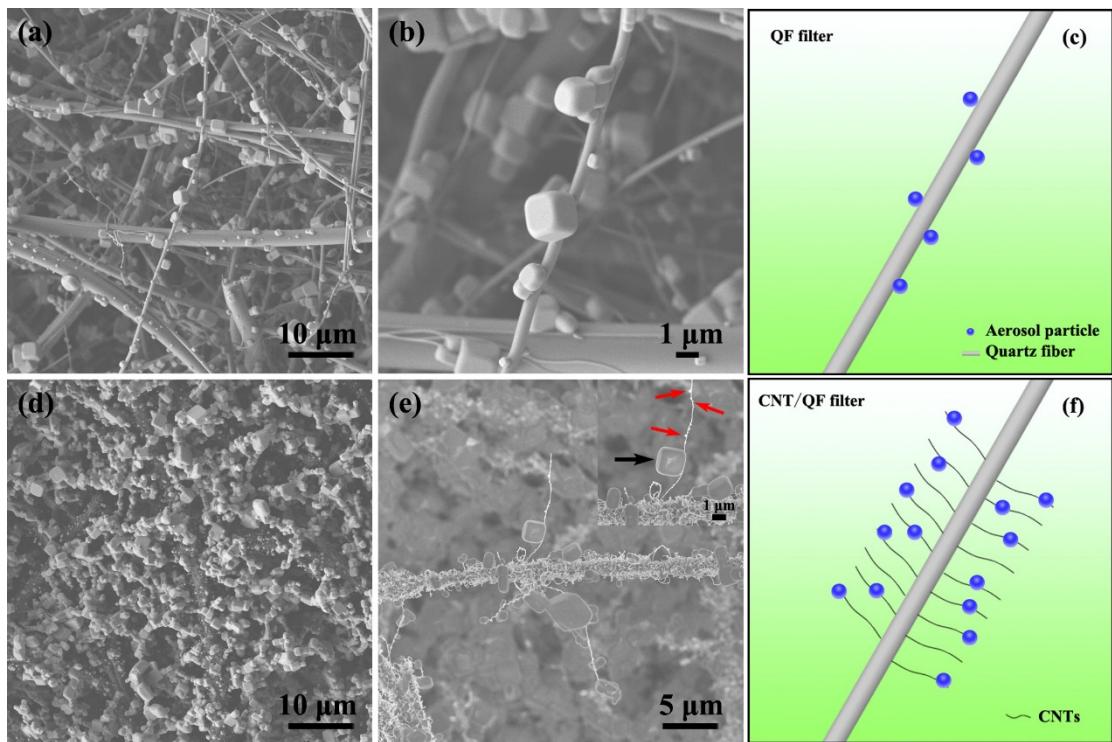


Fig. S6: SEM images of the filters with NaCl aerosol particles depositing for 60 seconds. (a, b) The QF filter of different magnifications, (c) illustration shows aerosol particles deposited on signal QF fiber. (d,e) CNT/QF filter of different magnifications, (f) illustration shows aerosol particles deposited on CNTs of CNT/QF filter. The inset in (e) shows NaCl particles deposited on a single CNT (the black arrow shows a large NaCl particle with diameter about 1 μm , red arrows show NaCl particles smaller than 100 nm).

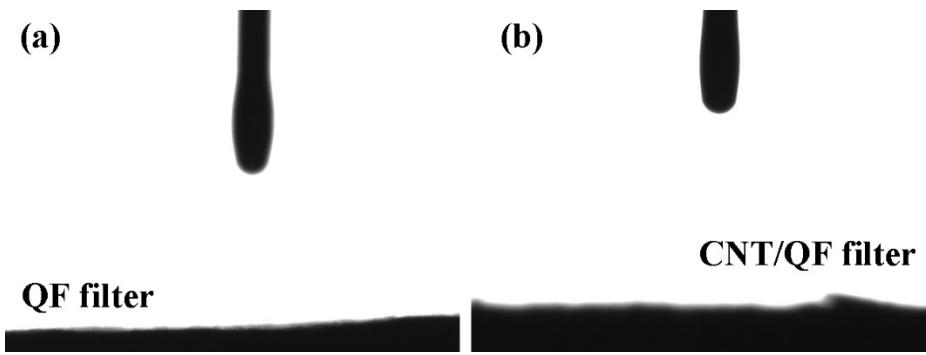


Fig. S7: The contact angles test of DEHS droplets on a QF filter (a) and a CNT/QF filter (b).

Table S1: Comparison of the filtration performance versus filtration test time of a QF filter and a CNT/QF filter with different way of placement under continuous aerosol loading:

	CNT/QF filter QF filter	CNT/QF filter with CNT-rich side upstream	CNT/QF filter with CNT-rich side downstream
Time when $\Delta P/\Delta P_0 = 2$ (minutes)	11	7.5	18
Penetration at MPPS (MPPS) with filtration time (minutes)			
0	2.45×10^{-4} (88.2 nm)	4.10×10^{-5} (68.5 nm)	4.13×10^{-5} (63.8 nm)
3	3.19×10^{-4} (88.2 nm)	6.42×10^{-5} (71 nm)	5.12×10^{-5} (73.7 nm)
6	4.64×10^{-4} (73.7 nm)	9.05×10^{-5} (85.1 nm)	4.20×10^{-5} (79.1 nm)
9	5.94×10^{-4} (85.1 nm)	1.94×10^{-4} (79.1 nm)	7.39×10^{-5} (82 nm)
12	7.76×10^{-4} (79.1 nm)	3.21×10^{-4} (76.4 nm)	7.92×10^{-5} (79.1 nm)