

Supporting information of the Manuscripts

Physical properties of poly(vinylidene fluoride) composites with polymer functionalized multiwalled carbon nanotubes using nitrene chemistry

Amit Mandal and Arun K. Nandi*

*Polymer Science Unit, Indian Association for the Cultivation of Science, Jadavpur,
Calcutta 700 032, India*

* For correspondence; E mail- psuakn@mahendra.iacs.res.in

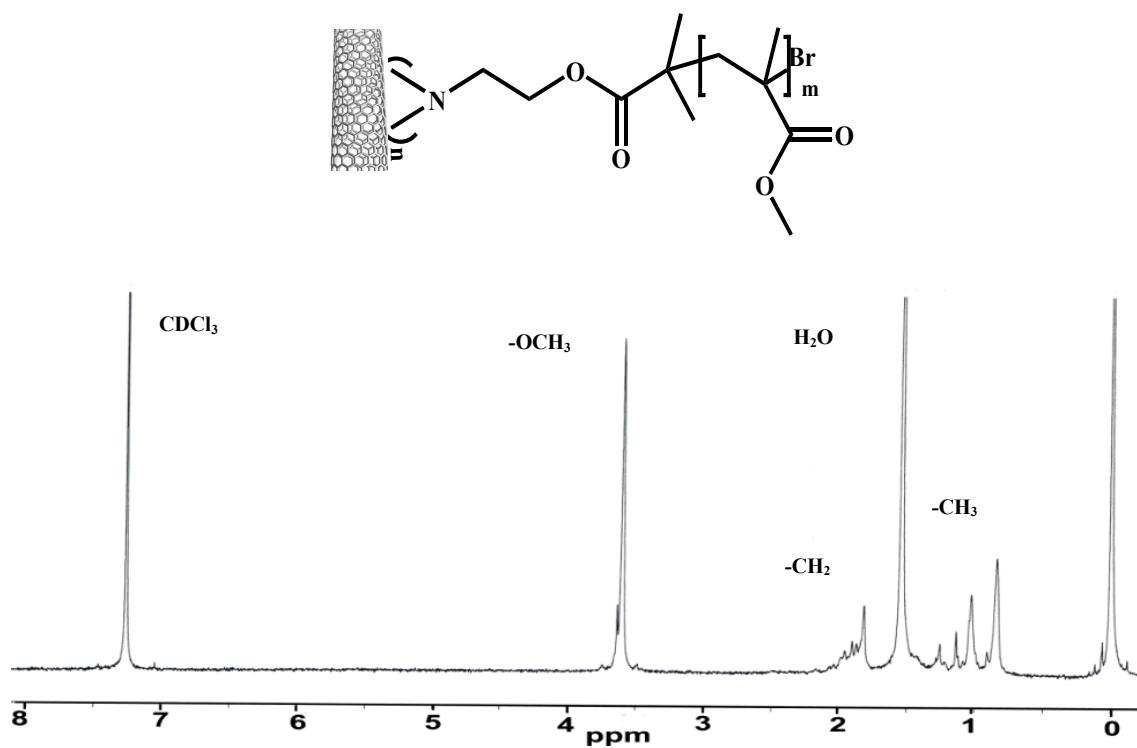
Synthesis of 2-Azidoethanol :-

In a 250 ml two-neck round-bottom flask fitted with a condenser sodium azide (32.5 gm, 0.5 mol) and 2-chloroethanol (17 ml, 0.25 mol) were added in 100 ml deionized water and was stirred with a magnetic stirrer in N₂ atmosphere. The flask was placed in an oil bath at 75 °C and was stirred for 72 h (caution: the azide is quite explosively sensitive to friction during feeding above 80 °C). After cooling to room temperature, the product was extracted with diethyl ether 3 times. The extracts were dried over anhydrous Na₂SO₄, the solvent was removed and distilled under reduced pressure to produce colorless oil. Yield: 32.6 gm, 75%. ¹H NMR (CDCl₃, δ, ppm): 3.79 (t, 2H, CH₂O), 3.43 (t, 2H, CH₂N₃), 2.21 (d, 1H, OH).

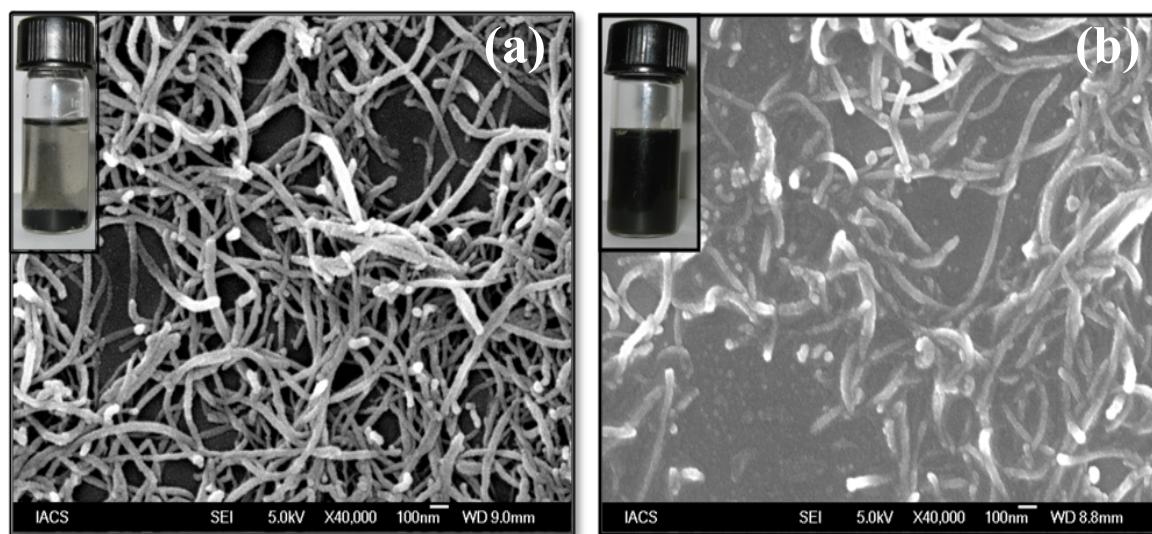
Synthesis of 2-Azidoethyl-2-bromo-2-methylpropanoate:-

In 250 ml two-neck round-bottom flask equipped with a pressure equalizer 2-Azidoethanol (5 gm, 0.06 mol), distilled anhydrous methylene chloride (35 ml), and distilled Et₃N (8 ml, 0.06 mol) were added. DMAP (0.48 gm, 4 mmol), distilled methylene chloride (25 ml), and distilled Et₃N (17.5 g, 0.17 mol) were added sequentially under nitrogen atmosphere and magnetic stirring. After the flask was immersed into an ice-water bath, 2-bromoisobutyryl bromide (7 ml, 0.06 mol) with 20 ml distilled methylene chloride were added dropwise into the solution from the pressure equalizer at 0 °C and after 12 hrs of stirring the reaction mixture was stirred at room temperature. Then it was washed successively with 1M HCl solution and deionized water subsequently. The organic phase was dried over anhydrous Na₂SO₄, methylene chloride

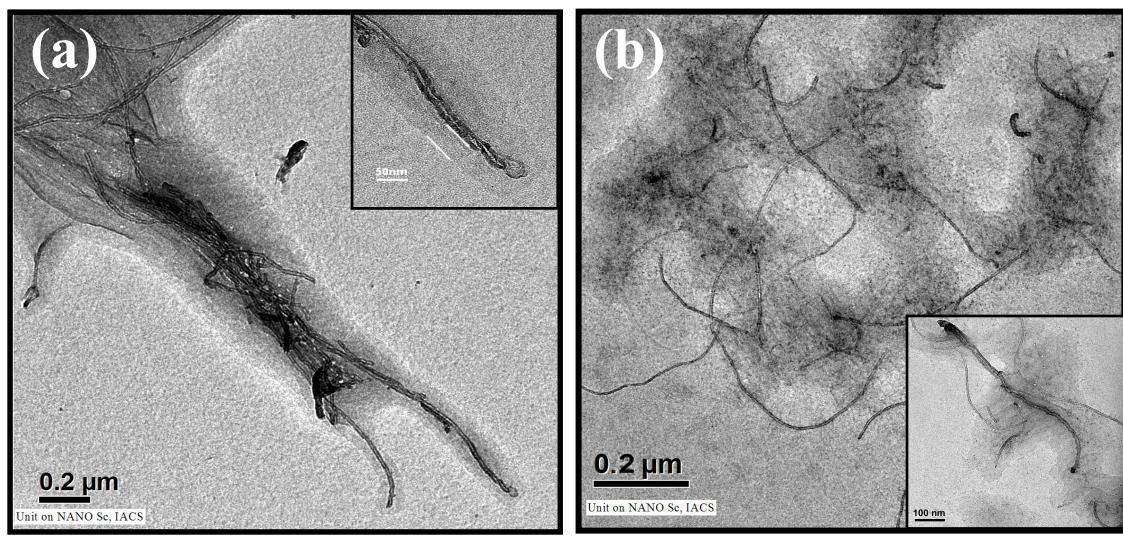
was removed on a rotary evaporator, the obtained product was distilled under reduced pressure to give colorless viscous liquid. Yield: 7.5 g, 53.3%. ^1H NMR (CDCl_3 , δ , ppm): 4.36 (t, 2H, $\text{N}_3\text{CH}_2\text{CH}_2$), 3.54 (t, 2H, N_3CH_2), 1.98 (s, 6H, $(\text{CH}_3)_2\text{Br}$).



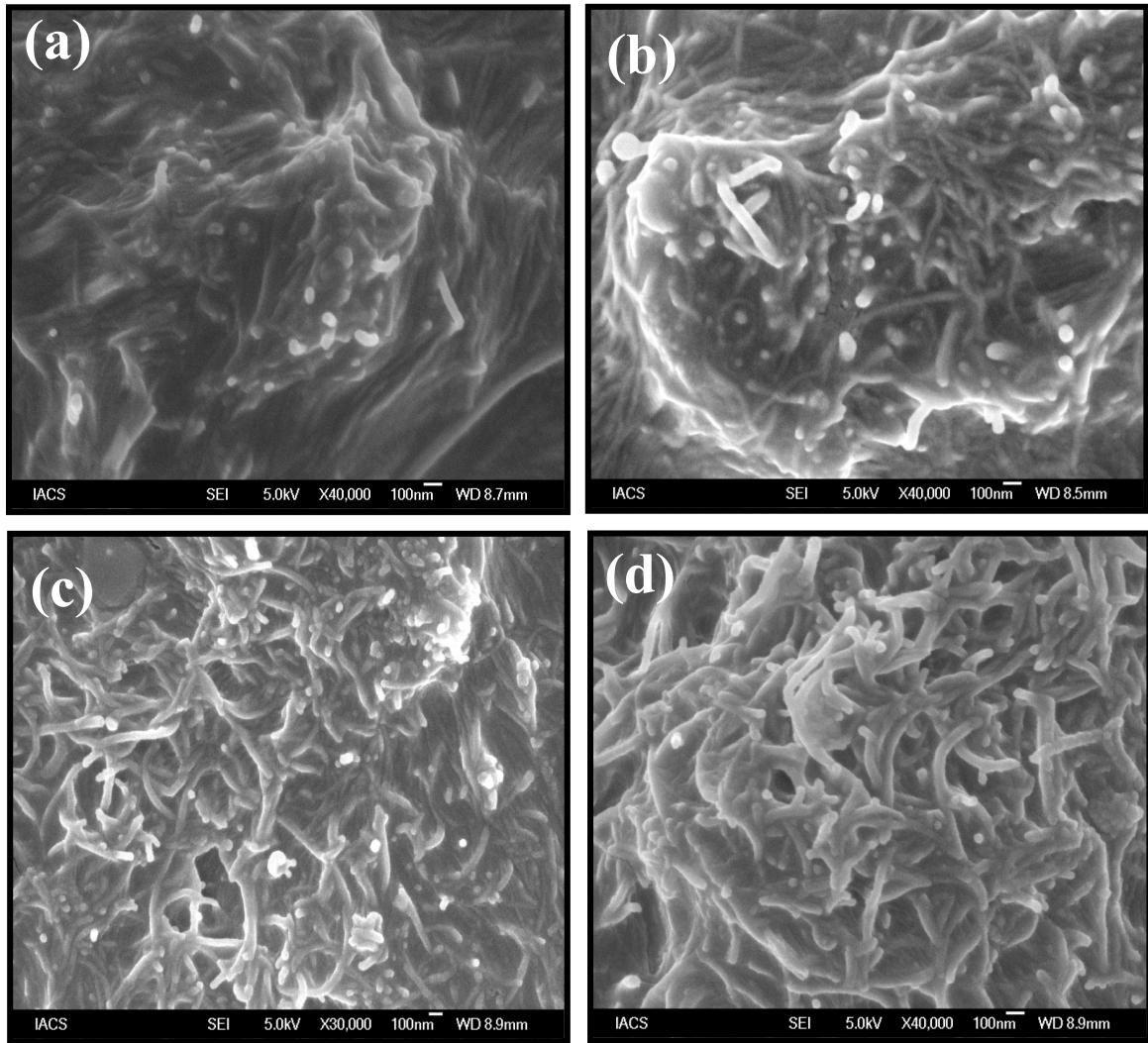
Supplementary figure 1. ¹H NMR spectrum of MWNT-g-PMMA in CDCl₃.



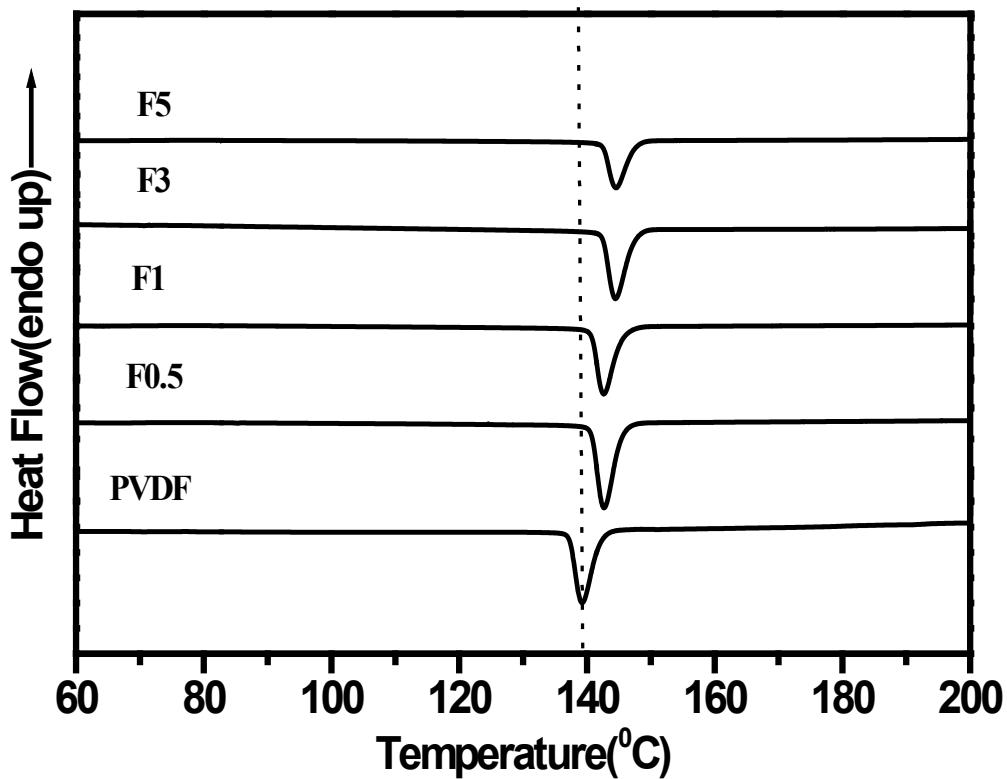
Supplementary figure 2. Representative FE-SEM images of (a) pristine MWNT, and (b) MWNT-g-PMMA.



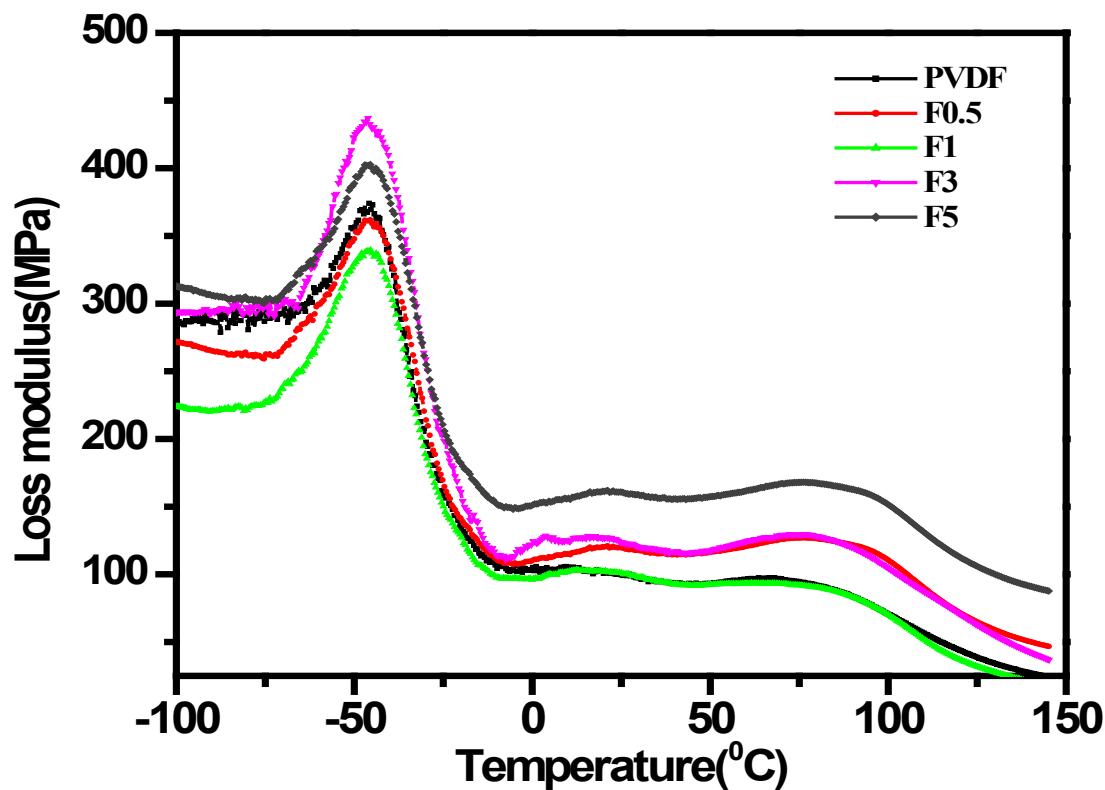
Supplementary figure 3. TEM pictures of PVDF/f-MWNT nanocomposites: (a) F0.5, (b) and F5 samples.



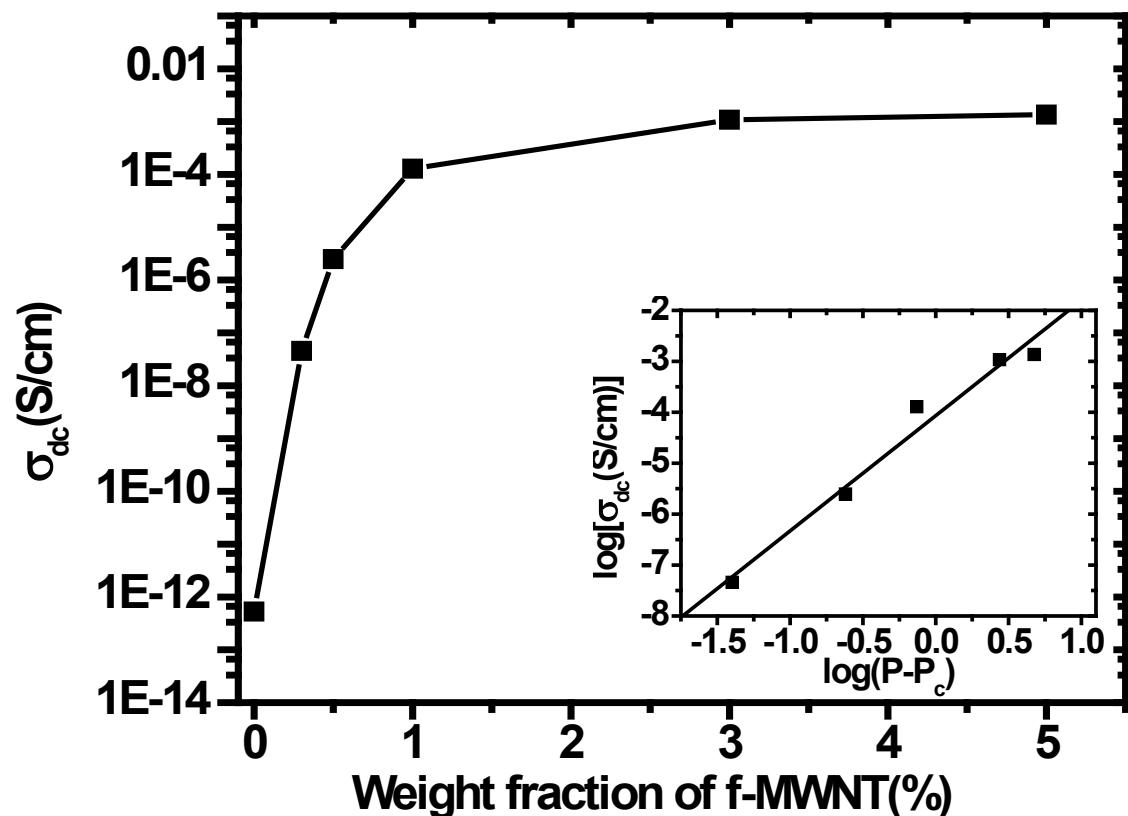
Supplementary figure 4. FE-SEM pictures of solvent-cast PVDF/f-MWNT nanocomposites: (a) F0.5, (b) F1, (c) F3 and (d) F5 samples.



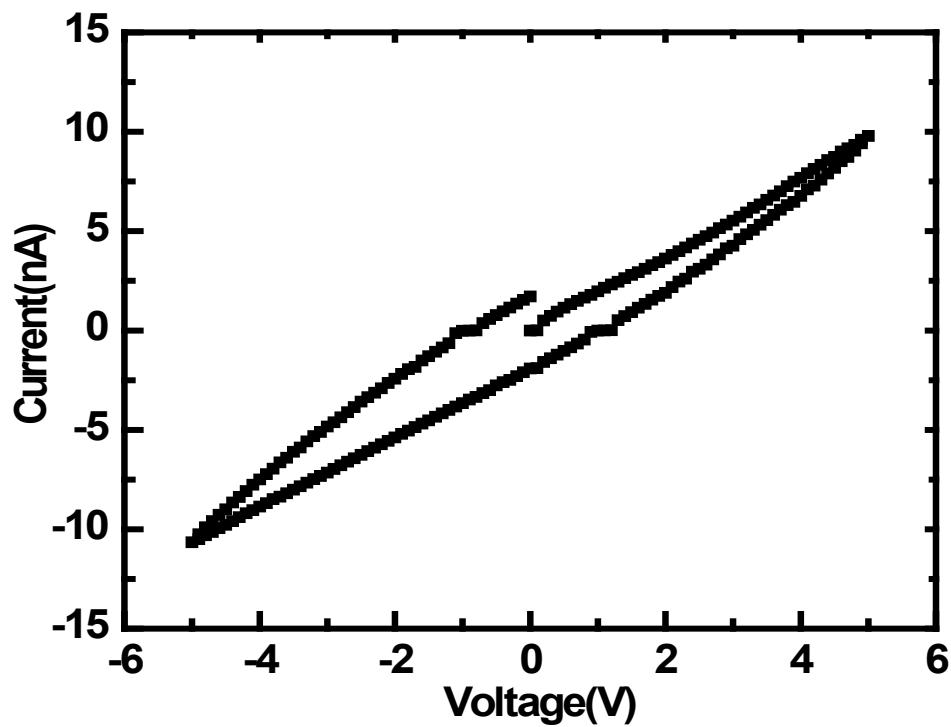
Supplementary figure 5. Crystallization isotherms of PVDF and different PVDF/f-MWNT nanocomposites films for cooling from the melt at the rate of 5 $^{\circ}$ C/min.



Supplementary figure 6. Loss modulus-temperature plots of PVDF and their nanocomposites films.



Supplementary figure 7. dc-conductivity of PVDF/f-MWNT composites as a function of the weight percent of the f-MWNT at 50°C . The inset shows the linear according to the percolation scaling law where the solid line corresponds to the best fitted line.



Supplementary figure 8. Current-Voltage (I-V) plot of F0.5 sample for the complete cycle of applied voltage at 30 °C.