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Electronic Supplementary Information

Mn_3O_4 nanoparticles anchored to multiwall carbon nanotubes: a distinctive synergism for high performance supercapacitor

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Materials. Manganese sulfate [$MnSO_4.H_2O$] and cetyl trimethylammonium bromide were procured from Sisco Research Laboratory, Mumbai, India and Merck, Gurgaon, India, respectively. Ethanolamine was purchased from Merck, Gurgaon, India.

Instruments.

The powder X-ray diffraction (XRD) measurement was carried out in a PW1710 diffractometer, a Philips, The netherlands, instrument and the XRD data were analyzed by (JCPDS) software. The field emission scanning electron microscopy (FESEM) was carried out with a supra 40, Carl Zeiss Pvt. Ltd to obtain the images and to acquire the size, shape, and morphology of the samples. An EDAX machine (Oxford link and ISIS 300) attached to the FESEM instrument was applied to attain the composition of the nanocrystals. The transmission electron microscopy (TEM) was carried out with an H-9000 NAR instrument, Hitachi, using an accelerating voltage of 300 kV. The electrochemical characterizations were done using Biologic SP-150 in a three-electrode cell configuration in aqueous 3 M KOH as electrolyte.

Calculation of specific capacitance at various frequencies:

The specific capacitance obtained from the EIS was calculated adopting the following equation:

$c_{sp} = -1/(m\omega Z_{img})$

where, m, ω and Z_{img} indicate the electrode mass, angular frequency and the imaginary impedance, respectively ,

The frequency dependent specific capacitance plot is shown in Fig. S1. The maximum specific capacitance of 9.7 and 14.3 F/g was obtained for the Mn_3O_4 and MWCNT/Mn_3O_4 composite, respectively at a low frequency of 0.1 Hz. With the increasing frequency the specific capacitance decreases at a fast rate and at high frequency both the materials show resistive behavior.

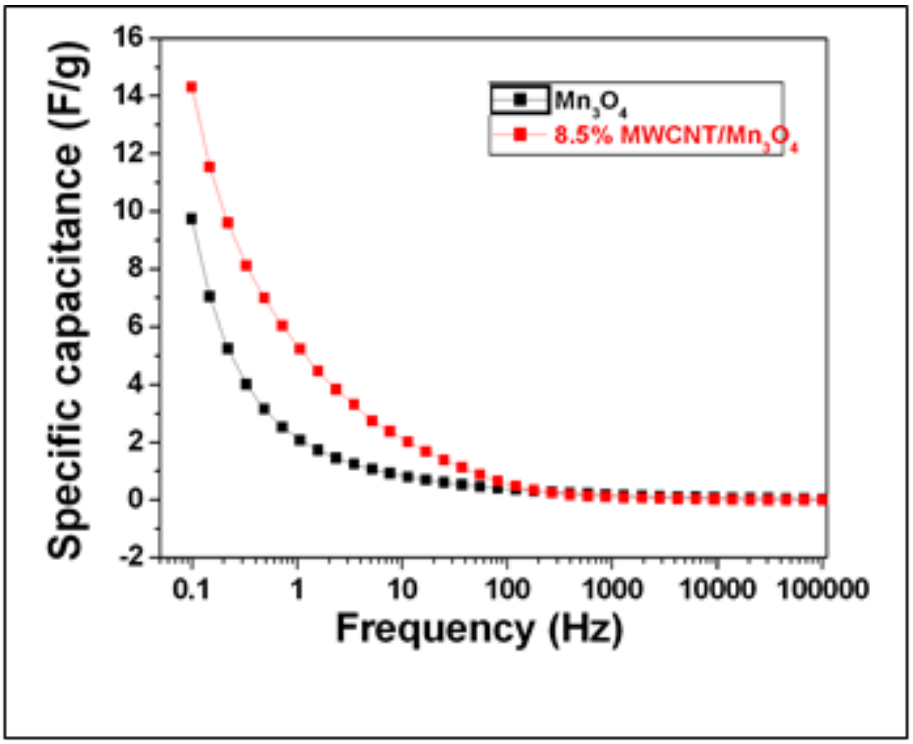

Fig. S1. Frequency dependent specific capacitance of the Mn3O4 and 8.5% MWCNT/Mn_3O_4 composite