Supporting Information

Homogeneous Fe_2O_3 coatings on carbon nanotube structures for supercapacitors

Pengmei Yu,[a] Mariona Coll,[a*]Roger Amade,[b,c] Islam Alshaikh, [b,c] Fernando Pantoja-Suárez, [b,c,d] Esther Pascual, [b,c] José Luís Andújar, [b,c] and Enric Bertran Serra [b,c]

[*a] Institut de Ciència de Materials de Barcelona (ICMAB-CSIC), Campus UAB 08193 Bellaterra (Barcelona) Spain. Email: mcoll@icmab.es; [b] Departament de Física Aplicada, Universitat de Barcelona, Martí i Franquès 1, 08028 Barcelona, Spain; [c] Institute of Nanoscience and Nanotechnology (IN2UB), Universitat de Barcelona, Avda. Joan XXIII, s/n, 08028 Barcelona, Spain; [d]Departamento de Materiales, Facultad de Ingeniería Mecánica, Escuela Politécnica Nacional, Ladrón de Guevara, E11-253, Quito, Ecuador

1 TEM-EDX Elemental mapping

In Figure S1 we display TEM images of ALD-30 nm Fe_2O_3@wpCNTs and ALD-6 nm Fe_2O_3@wpCNTs and their corresponding elemental mapping images and EDX sum spectra. The low amount of material in the 6 nm iron oxide-CNTs composite hinders the extraction of robust information from the elemental mapping. In contrast, the 30 nm composite show clear homogeneous iron oxide covering of the carbon nanotubes. From the EDX sum spectra it can be identified other elements such as Cu, Si, Ca and Cl that come from the TEM grid and sample manipulation during TEM sample preparation.

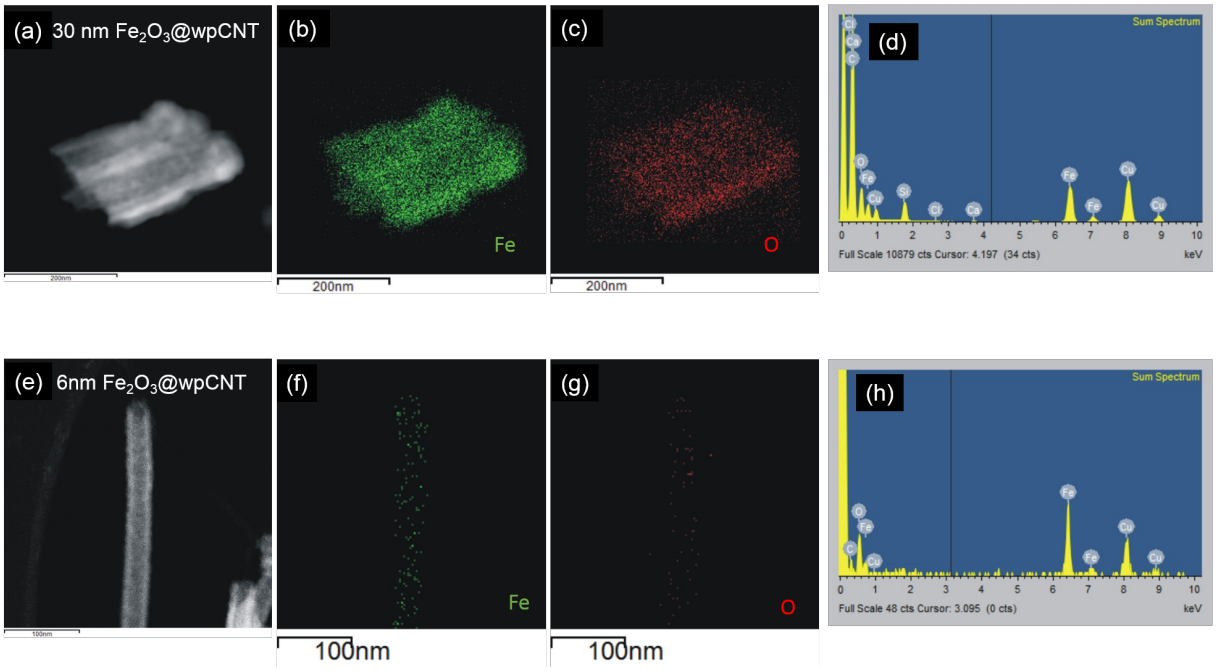

Figure S1: (a) TEM image of ALD-30 nm Fe_2O_3@wpCNTs, (b) elemental mapping of Fe Kα_1 signal, (c) elemental mapping of O Kα_1 signal, (d) EDX sum spectrum of the same region. (e) TEM image of ALD-6 nm Fe_2O_3@wpCNTs with the corresponding (f) elemental mapping of Fe Kα_1 signal and (g) elemental mapping of O Kα_1 signal. (h) EDX sum spectrum performed in (e).

2 XPS

The deconvolutions of high resolution XPS C 1*s* spectra of thinnest and continuous Fe_2O_3 films coated CNTs samples reveal various carbon environments in the surface: π-π interactions, C=O, C-O, sp^3 carbon and sp^2 carbon. See Figure S2. The areas of sp^3 carbon and sp^2 carbon in the deconvoluted spectra are tabulated in Table S1.

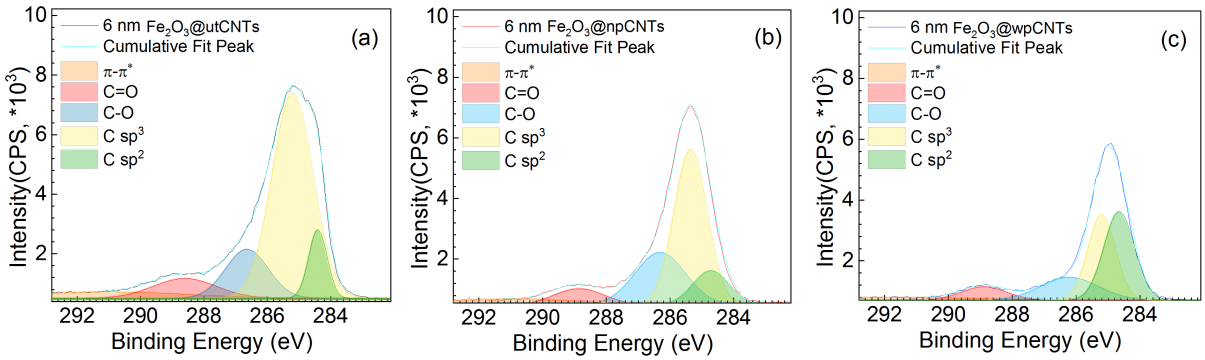

Figure S2: Deconvoluted XPS high resolution C 1*s* spectra of 6 nm Fe_2O_3@CNTs samples on (a) untreated CNTs, (b) nitrogen plasma CNTs, (c) water plasma CNTs.

Table S1: Relative area of sp^3 C and sp^2 C in the deconvoluted XPS C 1*s* spectra

Sample	sp^3 C (area)	sp^2 C (area)
6 nm Fe_2O_3@utCNTs	11210	1677
6 nm Fe_2O_3@npCNTs	6750	1650
6 nm Fe_2O_3@wpCNTs	3067	3500

3 GIXRD and XRR

GIXRD were carried out of the as-deposited iron oxide thin film on reference (100) silicon substrate. As is illustrated in Figure S3(a), the well-defined peaks in the diffraction curve can be readily indexed as pure phase α-Fe_2O_3 without any other impurities (Pdf card: 00-033-0664).
In Figure S3(b) we show a typical X-ray reflectivity curve of ALD-Fe_2O_3 coated reference Si. By fitting the experimental data, the thickness of ALD-Fe_2O_3 thin films is determined to be $\sim$ 22.5 nm.

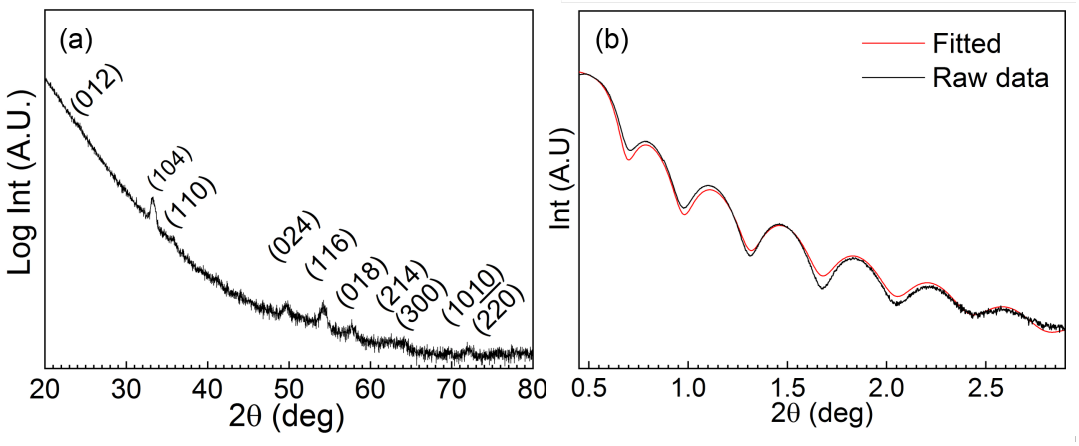

Figure S3: (a) GIXRD spectrum and (b) XRR raw data and fitted curves of ALD α-Fe_2O_3 thin films deposited at 250 °C on Si (100).