SUPPORTING INFORMATION

Microscopy investigations of the microstructure change and thermal response of the cobalt-based nanoparticles confined inside carbon nanotubes medium

Walid Baaziz,*a Ileana Florea, b,c Simona Moldovan, b Vasiliki Papaeftimiou, a Spiridon Zafeiratos, a Sylvie Begin-Colin, b Dominique Begin, a Ovidiu Ersen, *b and Cuong Pham-Huu a

a Institut de Chimie et Procédés pour l’Energie, l’Environnement et la Santé (ICPEES), UMR 7515 du CNRS-Université de Strasbourg, 25 rue Becquerel, 67087 Strasbourg-Cedex 02, France

b Institut de Physique et Chimie des Matériaux de Strasbourg, UMR 7504 du CNRS Université de Strasbourg, 23 rue du Loess, 67037 Strasbourg-Cedex 08, France

c Laboratoire de Physique des Interfaces et Couches Minces, UMR 7647 CNRS-Ecole Polytechnique, Route de Saclay, 91128, Palaiseau-Cedex, France
SI 1: XPS survey scan spectra of the pristine CNTs and those heated at 650°C in UHV. Inset: detailed scans of the O1s region. The oxygen atomic content is calculated from the O1s to C1s peak area ratio assuming a homogeneous distribution of the oxygen species in the analyzed volume.

SI 2: TGA curve of Co-based NPs@CNTs carried out under air with a heating rate of 5°C/min. Size distribution of NPs measured from the TEM images (red lines) and fitted with a Gaussian function (black line).
**SI 3:** TEM images of the Co-based/CNTs showing NPs localized inside the CNT’s channel with closed end, confirming the high diffusion of the cobalt precursor inside the CNTs channel by the solvothermal method.

**SI 4:** Representative HAADF-STEM image and corresponding EELS spectra recorded on different areas on the nanostructures constituted of Co-based nanoparticles deposited on FLG sheets.
SI 5: TEM image of the CoO/FLG system illustrating a completely different morphology compared to that corresponding to the CoO/CNTs system where confinement effect operates.

SI 6: Video of the 3D modeling

SI 7: HR HAADF-STEM analysis of Co-based NPs inside the CNTs