XXXII Panhellenic Conference on Solid State Physics and Materials Science
Conference Center "Carolos Papoulias", 18-21 September 2016, Ioannina, Greece

Solvothermal synthesis of carbon encapsulated cobalt nanoparticles and their response in magnetic hyperthermia.

A. Kotoulas[1*], C. Dendrinou-Samara[2], J. Arvanitidis[1], G. Vourlias[1], M. Angelakeris[1], O. Kalogirou[1]
[1]*Department of Physics, Aristotle University of Thessaloniki, 54124, Greece*
[2]*Department of Chemistry, Aristotle University of Thessaloniki, 54124, Greece*

Abstract: Herein we report the synthetic procedure of carbon encapsulated cobalt (Co@C) nanoparticles. All samples were solvothermally prepared, via the wet chemical reduction of a cobalt complex or cobalt acetate tetrahydrated in the presence of different polyols, such as propylene glycol (PG), tetraethylene glycol (TEG) or triethylene glycol (TrEG) and NαOH. In all cases, the reaction temperature, the heating rate and the reaction time were maintained immutable (200 ^{o}C, 2.5 ^{o}C/min and 24h respectively).

The structural characterization of the samples was performed via X-ray diffraction (XRD) and scanning electron microscopy technique (SEM). X-ray diffraction revealed the fcc structure of cobalt and provided an approximate calculation of cell dimensions, while the presence of carbon was also indicated. The elemental analysis, illustrated by SEM, showed excessively presence of carbon, probably due to a core-shell structure effect. The presence of carbon was also evidenced by Raman spectroscopy, where peaks that correspond to G-band (1590 cm^{-1}) and D-band (1350 cm^{-1}) of carbon were revealed.

Co@C nanoparticles present saturation magnetization of 38.8 emu/g and coercivity of 274 Oe. Magnetic particle hyperthermia measurements at a frequency of 765 kHz were carried out and the observed values of specific loss power (SLP) at a concentration of 0.5 mg/mL were 241.1 and 154.2 W/g at a field amplitude of 0.03 T and 0.025 T, respectively.

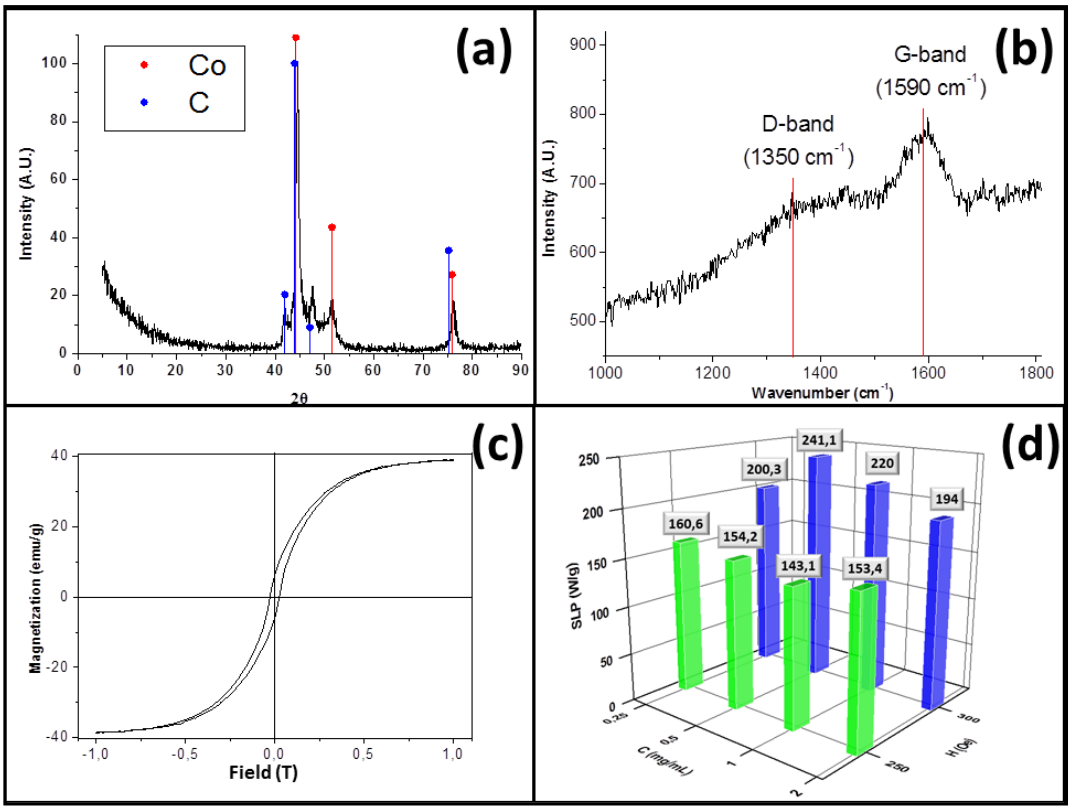

Fig. 1: (a) XRD pattern of Co@C nanoparticles, **(b)** Raman spectrum, **(c)** Magnetization loop, **(d)** SLP measurements for four different concentrations (0.25 to 2 mg/mL) at 0.025 T and 0.03 T.