Microwave assisted solvothermal controlled synthesis of Fe-Co composite material

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Abstract.
Syntheses of bimetallic cobalt-iron-based nanoparticles starting from $Co(acac)_2$ and $Fe(acac)_3$ (acac = acetylacetonate) were carried out by microwave-assisted solvothermal process, using ethylene glycol as the solvent and (polyvinylpyrrolidone) PVP, as the stabilizer. Indeed, the reaction mechanism in the presence of ethylene glycol is well understood [1] with the role of PVP being the inhibition of nanoparticles growth [2]. However, the control of the morphology of the synthetized nanoparticles is still a great challenge. Herein, we demonstrated that by adding amines to the reaction mixture, it is possible to control the morphology of the prepared bimetallic cobalt-iron materials. Thus, different Co-Fe micro-composites were synthetized by an innovative microwave assisted solvothermal synthesis, which allows to considerably reduce reaction time from 12 h to 15 min, with respect to classical thermal methods. The procedure was optimized by varying several parameters, such as: amount of PVP, in the presence or in the absence of amines, reaction temperature. The dark brown obtained powders were characterized by scanning electron microscopy, infrared spectroscopy and thermogravimetric analysis, confirming the beneficial effect of the presence of the amine in the morphology of the obtained composites. The obtained results open a new scenario for further studies on the possibility to control the morphology of bimetallic composite materials.

[1] Fievet F, Lagier J P and Figlarz M Mater. Res. Soc. Bull. 24 (1989) 29–34
[2] Teranishi T, Kurita R and Miyake M J. Inorg. Organometall. Polym. 10 (2000) 145–56