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Micro- and nanostructures of Ni-based ternary compounds with applications in sensors and batteries

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The development of low dimensional micro- and nanostructures of ternary compounds with controlled morphology and composition is recently gaining increasing attention due to their improved functionalities and enhanced performance in diverse fields of research. However their fabrication is not an easy task and diverse synthesis approaches have been followed so far.
In this work Ni-based ternary compounds in form of nano- and microstructures have been synthesized following different physical and chemical routes. NiGa2O4 elongated micro- and nanostructures were fabricated by a vapor-solid method using a controlled mixture of Ga2O3, metallic Ni and Ga as precursors. In that case, thermal treatments at 1400-1500 ⊠C under a controlled Ar atmosphere lead to the growth of nanoneedles and rods with lengths up to several microns, following an autocatalytic process. On the other hand, a co-precipitation route was used for the synthesis of NMC compositions in submicrometric core/shell structures leading to the formation of Ni-rich core and Mn-rich shell at each particle, including Ni-ternary compounds.
Electron microscopy techniques (SEM, TEM) were employed for the morphological analysis of the Ni-based ternary nano- and microstructures. The structure and composition of the obtained samples, as well as the presence of NiO or other secondary phases have been analysed by x-ray diffraction and energy dispersive x-ray spectroscopy (EDS). Photoluminescence and Raman spectroscopy using variable excitation conditions and micrometric resolution have been employed for the analysis of the samples. Special attention has been paid to the study of the vibrational modes of the Ni-based ternary compounds, as the identification and understanding of some Raman modes still remains controversial in these materials [1].
These micro and nanostructures have demonstrated potential applicability as electrodes in Li-ion batteries, as well as in sensors and photodetectors.

[1] X. Ma, C.Wang, G. Wang et al., J. Industrial and Eng. Chem. 66, 141-157 (2018)

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