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Cation-exchange synthesis of nickel ferrite on an organic matrix

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Abstract

A new method of synthesis of nanosized nickel ferrite with spinel structure is converted, using organic matrix. The role of the organic matrix performs pre-synthesized cation exchange material having a high exchange capacity. In contrast to the known methods of deposition of metal hydroxides by ion exchange materials, a method is proposed for synthesis based on cationic exchange of protons of the ion exchanger for metal ions (iron and nickel) from a solution. The synthesis consists in gradual treatment of cation-exchange material in the H-form, solutions of salts of the respective metals. Cation exchange resin containing metal ions in equimolar proportions is subjected to annealing, resulting in complete combustion of the organic matrix and the formation of the phase ferrite of Nickel. It is established that the sequence of addition of salts does not affect the phase composition of the final product.

The obtained samples were examined by X-ray diffraction, scanning electron microscopy. X-ray phase analysis revealed the formation of spinel structure with space group Fd3m. The average size of crystallites, calculated using the equation of Debye-Scherrer width of the X-ray peaks depends on the annealing temperature and varies from 20 nm at 500 ºC to 100nm at 1000 ºC. The parameter α of the cubic spinel lattice made up 8.33 Å. Thermogravimetric studies showed that when heated, the resin treated with salts of metals, there is a flow of sequential processes decomposition of cation, combustion, carbon residue, decomposition of the chloride and finally sulphate of iron and Nickel with formation to 815 °C phases ferrite nickel.

The main advantage of the proposed method is the high degree of homogenization of initial components and a sufficiently low temperature synthesis. It is shown that by using this method it is possible to obtain nanosized ferrite powder of nickel.

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