

Nanocomposites and nanomaterials

Synthesis and catalytic properties of Ni_xCu bimetallic nanoparticles

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Ni_xCu bimetallic (x = 1, 3, 4) nanoparticles have been synthesized via reducing of as-prepared mixes of nickel and copper hydroxides by hydrazine hydrate in ethylene glycol. It was observed that obtained nanoparticles possess ferromagnetic properties and can be easily removed from reaction mixture by magnet. Using scanning electron microscopy (SEM) it was found that the sizes of obtained Ni_xCu nanoparticles at the all of cases are less than 100 nm (Table).

Analysis of X-ray diffraction patterns of obtained Ni_xCu nanoparticles showed that the all powders consist of two phases, molar ratios of Ni : Cu in the final products are in good agreement with the molar ratios of hydroxides in the reaction mixtures (Table) as well as was found that obtained nanopowders not possessed any oxides.

Table. Particles sizes and crystallographic parameters of Ni_xCu nanopowders.

	Ni ₄ Cu	Ni ₃ Cu	NiCu
Particles size (SEM), nm	30–80	25–60	25–70
Phase 1 (Ni) content, % at.	78.1(4)	70.1(7)	43(2)
Phase 2 (Cu) content, % at.	21.9(4)	29.9(7)	57(2)
Lattice parameter (Phase 1), Å	3.5274(2)	3.5341(5)	3.560(4)
Lattice parameter (Phase 2), Å	3.5944(4)	3.5977(7)	3.6061(4)
Crystallite size (Phase 1), nm	9.24(6)	9.8(3)	9.5(2)
Crystallite size (Phase 2), nm	9.33(17)	16.2(11)	9.5(2)

Taking into account the detected ferromagnetic properties of Ni_xCu nanoparticles such bimetallic nanopowders are interesting materials for magnetoseparative catalysts preparation. Using the model reaction of initiated by azobisisobutyronitrile aerobic oxidation of cumene it was shown that the rate of oxygen absorption by reaction mixture in the presence of 20 mg/ml of Ni₃Cu nanoparticles increased in twice.

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