

# Nanocomposites and nanomaterials

## Synthesis and catalytic properties of Ni<sub>x</sub>Cu bimetallic nanoparticles

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Ni<sub>x</sub>Cu 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<sub>x</sub>Cu nanoparticles at the all of cases are less than 100 nm (Table).

Analysis of X-ray diffraction patterns of obtained Ni<sub>x</sub>Cu 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<sub>x</sub>Cu nanopowders.

	Ni <sub>4</sub> Cu	Ni <sub>3</sub> 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<sub>x</sub>Cu 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 Ni<sub>3</sub>Cu nanoparticles increased in twice.

\* The SEM images and XRD patterns of Ni<sub>x</sub>Cu in this work were obtained with the expert assistance of Prof. I. Yu. Zavalij (Karpenko Physico-Mechanical Institute, NAS of Ukraine) and Prof. P. Yu. Zavalij (X-ray Crystallographic Center, University of Maryland).