NANOCOMPOSITES BASED ON Co NANOPARTICLES FOR CATALYTIC HYDROGENATION OF QUINOLINE

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Development of new catalysts for hydrogenation of heterocyclic compounds is important task of physical and organic chemistry, because such systems are highly demanded for synthesis of active pharmaceutical ingredients, effective substances for plant protection etc. The composites based on 3d metal nanoparticles can have high catalytic activity in such processes, and thus are considered as an alternative for the catalysts based on Pt and Pd.

The aim of this work was to study the influence of the composition and structure of composites of graphene-like carbon and nanosized 3d metals, prepared by pyrolysis of metal complexes on the different carriers, on their catalytic activity in quinoline hydrogenation.

The nanocomposites of were prepared by pyrolysis of Co(II) complexes with N-containing organic ligands (phenanthroline, melamine, 1,2-diaminobenzene) on aerosil (highly disperse SiO_2) and ZrO_2. Only metallic Co was found as Co-containing phase by powder XRD. It was shown by transmission electronic microscopy that the size of metallic nanoparticles was *ca*. 10–50 nm. The composites also contained carboneous particles, which had Raman spectra typical for multilayer graphene; the thickness of the particles could be evaluated as more than 8-10 layers.

The catalytic properties of the composites in hydrogenation of quinoline were studied. It was found that 1,2,3,4-tetrahydroquinoline (THQ) was the main product, at the same time minor quantity of N-methyl-1,2,3,4-tetrahydroquinoline formed. The yield of THQ varied from 40 to almost 100 % at 50 atm of H_2, 150 ºC in methanol (reaction time 24 h, catalyst loading 1 mol. %). "Washing out" of cobalt from the composites led to almost complete loss of their catalytic activity, proving that hydrogenation occurred on metallic Co nanoparticles rather than carboneous components. Formation of N-methyl-1,2,3,4-tetrahydroquinoline can be explained by methylation of THQ by methanol via hydrogen borrowing mechanism.

Thus, pyrolysis of Co-containing precursors is a simple and convenient way for preparation of efficient catalysts for hydrogenation of organic compounds. The developed catalysts can be considered as alternative to Pd- and Pt-based systems for routine large-scale hydrogenation of organic compounds.