Cobalt-containing conducting polymers on carboneous supports for catalytic hydrogenation of quinoline

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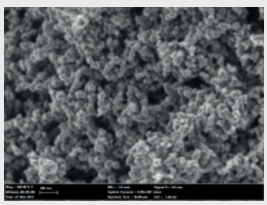
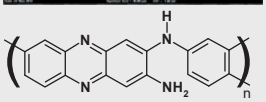
Introduction and Aim

Catalytic hydrogenation processes are widely used in modern organic chemistry for synthesis of active pharmaceutical ingredients, biologically-active compounds for agrochemistry, etc. Such reactions are usually carried out with catalysts, based on platinum group metals (Pt, Pd, Rh), which are quite expensive. Search of active catalysts containing only 3d metals for large-scale hydrogenation processes is important task.

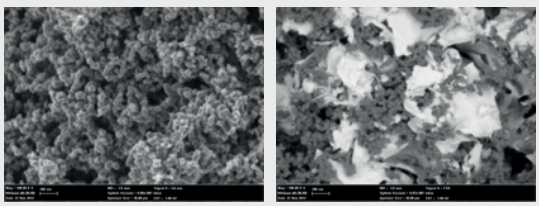
The aim of this work was to evaluate catalytic activity of the Co-containing conducting polymers – polyindole (PIn) or poly-m-phenylenediamine (PmPDA) – deposited on carboneous carriers (graphene oxide or acetlyene black) in reaction of quinoline hydrogenation.

Synthesis of the composites



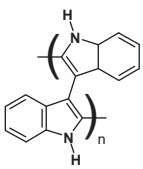


poly-*m*-phenylenediamine

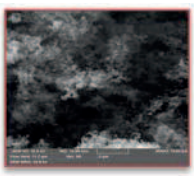


The carrier was evenly covered by the conduction polymer
Co was deposited as Co-containing particles

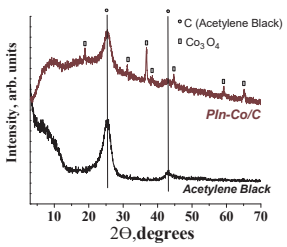
Similar synthetic scheme was used for preparation of composites based on polyindole ($FeCl_3$ was used instead of $(NH_4)_2S_2O_8$)



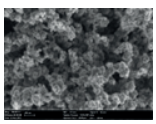
polyindole



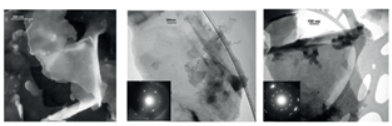
PIn-Co/C



Carriers

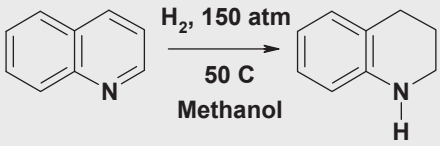


AB – acetylene black

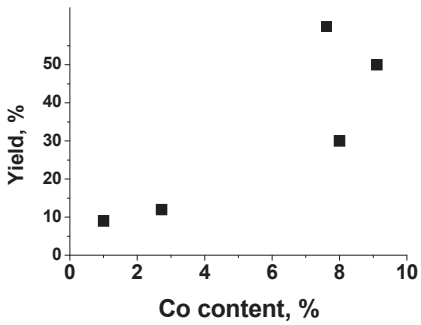


Multilayer graphene or graphene oxide (prepared by electrochemical exfoliation of graphite)

Catalytic activity in quinoline hydrogenation



The yield of tetrahydroquinoline was calculated by ^1H NMR and GCMS analysis of the products mixture



Yields of 1,2,3,4-tetrahydroquinoline *vs.* Co content in samples

Catalytic activity of the composites containing PmPDA or PIn was higher compared to the ones, based on solely carbon or N-doped carbon carrier, evidencing that the conducting polymers played important role in the catalytic activity.

Replacement of polyindole by poly-m-phenylenediamine resulted in 2-fold increase of the catalytic activity (measured as the yield of tetrahydroquinoline) at similar Co content.

The composites containing acetylene black as carrier showed up to 100 % yield of tetrahydro-quinoline, while the composites based on graphene or graphene oxide showed less than 80 % yield.

Contacts

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