

Nanocomposites and nanomaterials

Catalytic activity of Pd nanoparticles on carriers of different nature in Suzuki reaction

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The aromatic cross-coupling reactions are highly demanded in synthesis of compounds, important for fine chemical synthesis, in particular, bio-active molecules [1]. These methods are widely used for production of chemicals in agriculture and pharmaceuticals. Creation of stable and reusable nanocomposites and nanomaterials, possessing catalytic activity and site-selectivity, is one of the greatest challenges of modern organic synthesis [2].

The study is aimed on investigation of the effect of the nature of solid carrier on catalytic activity of Pd nanoparticles, deposited thereon, in Suzuki reaction. The cross-coupling of phenylboronic acid and bromobenzene was used as a model reaction.

The composites Pd/C₃N₄, Pd/MIL-101, Pd/Al₂O₃ were prepared and studied (MIL-101 is porous coordination polymer of Cr(III) with p-phthalate (bdc²⁻), [Cr₃O(bdc)₃(OH)(H₂O)₂]_n). These nanocomposites were synthesized by formation or deposition of Pd nanoparticles on the carrier (C₃N₄, MIL-101 or Al₂O₃). Nanoparticles size varies from 4.7 nm to ~20 nm. The size of Pd particles was determined by SEM and TEM.

It was shown that the use of Pd nanocomposites in Suzuki coupling of bromobenzene and phenylboronic acid led to biphenyl, as the main product, with yield up to 85% for 30 minutes. The reaction was carried out under mild conditions at the room temperature on air. The nanoparticles size in these materials varies from 4.7 nm up to 7.1 nm. It was shown that the catalytic activity of Pd/Al₂O₃ nanocomposites depended on Pd particles size, the highest activity was found for the particles with 6.5 nm size.

1. Chatterjee A, Ward Th. R. *Recent Advances in the Palladium Catalyzed Suzuki–Miyaura Cross-Coupling Reaction in Water // Catal. Let. -2016.- 146.- P. 820-840.*

2. Dhakshinamoorthy A., Asiric A. M., Garcia H. *Metal–organic frameworks catalyzed C–C and C–heteroatom coupling reactions // Chem. Soc. Rev.-2015.-44.-P. 1922-1947.*