

Highly efficient PdAg nanoalloys as catalysts in the N-formylation of nitroarenes and amines using formic acid or CO₂ and dimethylamine borane

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Streszczenie

Three new bimetallic PdAg nanoalloys were obtained by reducing a mixture of Pd and Ag complexes bearing long-chain carboxylate ligands with 1,1,3,3-tetramethyldisiloxane (TMDSO). The structure and composition (Pd:Ag = 1) of the prepared nanoalloys were confirmed using STEM, XRD, EDS and FT-IR. These nanoalloys efficiently catalyzed the N-formylation of nitroarenes to N-formamides at 50°C; in this reaction, formic acid acted as both a hydrogenating agent and a formyl group donor. Under the same conditions, Pd and Ag nanoparticles were practically inactive. Mechanistic studies revealed that the first step of the reaction involves PdAg-catalyzed hydrogenation of the nitroarene to the relevant amine. In the second step, the amine reacts with formic acid to form N-formamide, even in the absence of a catalyst. Additional studies involving various amines, CO₂, and dimethylamine borane (DMAB) demonstrated the PdAg nanoalloys' high catalytic activity in selectively forming N-formamides in this process. The advantages of using PdAg nanoalloys in both procedures for synthesizing N-formamides were discussed.

Słowa kluczowe

PdAg nanoalloys, Nitroarene formylation, Amine formylation, Formic acid, N-formamide, Carbon dioxide

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