Which Metals Are Efficient and Green for Catalysis? Comparison of Fe, Ni, Cu, Co, Rh and Pd for Catalyst Design in Organic Synthesis

Valentine P. Ananikov*

Zelinsky Institute of Organic Chemistry, Russian Academy of Sciences, Leninsky Prospekt 47, Moscow, 119991, Russia; http://AnanikovLab.ru; e-mail: val@ioc.ac.ru

Fascinating development of transition metal catalysis created a new paradigm in organic synthesis towards preparation of functionalized molecules with atomic precision [1]. Detailed mechanistic studies have shown that homogeneous catalytic reactions, traditionally considered with monometallic active species, are in fact carried out in multicomponent reaction mixtures, which contain a number of metal species in solution. Participation of different metal species in the catalytic transformation initiates formation of “cocktail”-type systems [2]. Tuning of “cocktail” of catalysts provides outstanding opportunity to create dynamic and adaptive catalytic systems (Figure 1). Heterogeneous catalysis may also involve formation of a number of active species that possess dynamic properties and interconversions on the surface [3].

![Figure 1. Multiple-type and single-type species catalysis and the influence of contamination.](image)

As far as transition metal catalysis is concerned, an important issue is contamination of the products with traces of metal species. The topics related to construction of efficient and selective catalytic systems with traceless operation will be presented and discussed.

A valuable direction of research is reducing the cost of metal catalysts and application of easily available metal precursors [4,5]. However, an important topic is to consider environmental profiles of metal catalysts [6]. Comparative analysis of catalysts efficiency and design of environmentally friendly catalysts for synthetic applications based on Fe, Ni, Cu, Co, Rh and Pd complexes will be also presented and discussed.

References