How do NHC ligands interact with metal complexes in solution? Efficient catalysis provided by dynamic metal-ligand frameworks

Valentine P. Ananikov

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

In recent decades, development of catalytic systems provided the major driving force for the paramount progress in the areas of pharmaceutical chemistry, access to new drugs, fine organic synthesis, chemical industry, fuels, biomass conversion, green and sustainable technologies, among many other directions.

Highly active molecular catalysts, involving a single metal atom surrounded by special organic ligands, are ubiquitously utilized for synthetic procedures in the area of homogeneous catalysis. Metal nanoparticles, stabilized on suitable supports, are used in many industrial and research applications of heterogeneous catalysis.

The attempts to understand the nature of catalytic reactions reveal a very complicated mechanistic picture, the concept of which has undergone several developmental "waves", from simple molecular catalysis to complex dynamic nanoparticle systems (Figure 1) [1].

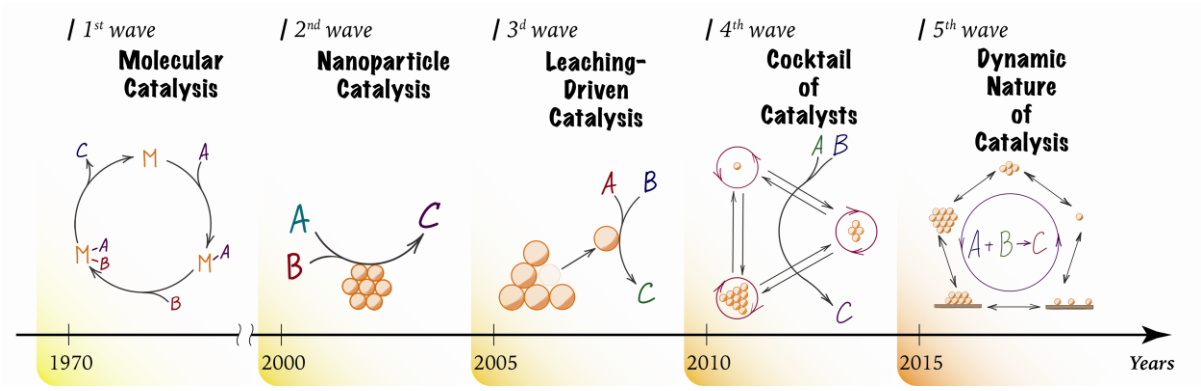

Figure 1. Mechanistic studies of catalytic reactions [1].

The present lecture will introduce the overall complexity of catalytic cycles with the main emphasis on unraveling the hidden reaction mechanisms by using powerful analytic methods of contemporary chemistry [1, 2]. Understanding of complex reaction mechanisms in catalysis is essential for the development of advanced chemical technologies with improved efficiency, selectivity and practical utility.

[1] Eremin D.B., Ananikov V. P., *Coord. Chem. Rev.*, **2017**, 346, 2; doi: 10.1016/j.ccr.2016.12.021.
[2] Kashin A. S., Degtyareva E. S., Eremin D. B., Ananikov V. P., *Nature Commun.*, **2018**, 9, 2936; doi: 10.1038/s41467-018-05350-x