

## Catalysis with Transition Metals: Tinder<sup>®</sup> with Molecules

Marko Hapke

Institute for Catalysis (INCA), Johannes Kepler University Linz, 4040 Linz, Austria

Group 9 metal compounds and especially cobalt complexes are frequently used catalysts for a large variety of not only cyclisation reactions, including the prominent Pauson-Khand or [2+2+2] cycloaddition reactions, but also prominent C-H functionalisation reactions.[1] The common ground of these transformations are the activation and connection of molecules and molecular fragments, which would normally hesitate to react under “normal” (in the organic chemists’ sense) conditions.

The talk will discuss the systematical development of novel cobalt-based catalysts for cyclotrimerisation reactions of building blocks like alkynes, diynes, oligoynes, as well as heteroatom analogues like nitriles and phosphalkynes, leading to interesting molecules with an aromatic core of benzene, pyridine or phosphabenzene fragments under thermal and photochemical reaction conditions. Appropriate combination of the neutral ligands for Co(I)-complexes can afford air-stable and recyclable, yet reactive precatalysts.[2] Approaches for heterogenisation of Co(I)-based catalysts will also be presented, including intricacies of substrate syntheses as requirements for successful cyclisations. Further novel developments of asymmetric cyclotrimerisation reactions using cobalt and rhodium catalytic systems will also be showcased.[3]

In contrast to [2+2+2] cycloadditions, the development of cobalt-catalysed C-H functionalisation reactions has only very recently seen significant progress and developing novel catalysts has turned out to be a challenging task. Efforts of our group towards the preparation of such cobalt catalysts (and others) and their properties and potential applications will be discussed.

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[1] N. Weding, M. Hapke, *Chem. Soc. Rev.* **2011**, *40*, 4525-4538.

[2] a) P. Jungk, F. Fischer, I. Thiel, M. Hapke, *J. Org. Chem.* **2015**, *80*, 9781-9793; b) I. Thiel, A. Spannenberg, M. Hapke, *ChemCatChem* **2013**, *5*, 2865-2868.

[3] a) I. Thiel, M. Horstmann, P. Jungk, S. Keller, F. Fischer, H.-J. Drexler, D. Heller, M. Hapke, *Chem. Eur. J.* **2017**, *23*, 17048-17057; b) P. Jungk, F. Fischer, M. Hapke, *ACS Catalysis* **2016**, *6*, 3025-3029.