

Recent developments in the chemistry of aromatic phosphorus heterocycles: From fundamental aspects to applications

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Due to a modular synthetic approach, we have lately demonstrated the access to various donor-functionalized 2,4,6-triaryl- λ^3 -phosphinines (phosphabenzenes, type A, Figure 1), including phosphorus derivatives of 2,2'-bipyridine and terpyridine. By making use of the chelate effect, we could demonstrate for the first time that neutral P,N and anionic P,C hybrid ligands form easily coordination compounds with transition metal centers in both low as well as medium to high oxidation states, which is an important aspect for applications in more applied research fields.

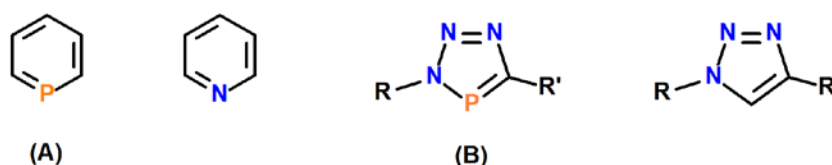


Figure 1. Phosphinine (A) and triazaphosphole (B) and comparison with their nitrogen-analogues.

Inspired by these findings, we started to investigate also other classes of functionalized, low-coordinate phosphorus compounds. We anticipated that derivatives of 3*H*-1,2,3,4-triazaphospholes (type B, figure 2) are suitable candidates, as they can generally be prepared in a modular “click”-reaction, starting from azides and phosphalkynes. First results show indeed, that this powerful tool can be used as well for the straightforward and simple preparation of donor-substituted, chelating triazaphospholes.

This lecture will focus on the design and preparation of especially pyridyl-functionalized phosphinines and triazaphospholes. The access to such compounds provides new perspectives for areas of chemical research, which are otherwise dominated by transition metal complexes based on pyridine-, bipyridine- and terpyridine-based ligands. A detailed comparison of the here-presented low-coordinate phosphorus compounds with their structurally related nitrogen-counterparts, having an identical substitution pattern, will be provided.



Christian MÜLLER was born in Germany in 1972. He studied Chemistry at the University of Bielefeld and the University of Michigan, Ann Arbor (USA) and received his Ph.D. under the supervision of Prof. Dr. P. Jutzi at the University of Bielefeld/Germany in 2000. He was awarded with a fellowship of the Deutsche Forschungsgemeinschaft (DFG) to work with Prof. Dr. W. D. Jones at the University of Rochester, New York (USA) and started in 2002 a second postdoc with Prof. Dr. P. W. N. M. van Leeuwen at the University of Amsterdam, The Netherlands. Afterwards he joined the group of Prof. Dr. D. Vogt at Eindhoven University of Technology in 2003 where he got appointed as Assistant Professor in 2004. In 2008 he received the prestigious Vidi grant from the Netherlands Organization of Scientific Research (NWO) to conduct research in the field of low-coordinate organophosphorus chemistry. In summer 2011 he got nominated to Associate Professor of Inorganic Chemistry and Homogeneous Catalysis at Eindhoven University of Technology, which he refused to accept. Instead he got appointed full Professor of Inorganic Chemistry at the Free University of Berlin, Germany, where he started in February 2012. His research

interests are centered around the subjects “low-coordinate phosphorus and arsenic compounds”, “activation of small molecules”, “functional coordination compounds”, and “homogeneous catalysis”.