

Multifaceted Chemistry with Phosphorus-Functionalised Ferrocene Derivatives

Evamarie Hey-Hawkins

Universität Leipzig, Faculty of Chemistry and Mineralogy, Institute of Inorganic Chemistry,
Johannisallee 29, D-04103 Leipzig, GERMANY

E-mail: hey@uni-leipzig.de; Webpage: <http://research.uni-leipzig.de/hh/>

Cyclopentadienes with a P-functionalised alkyl or aryl side chain are useful precursors for mono- and dianionic bifunctional ligands in main group and transition metal chemistry. We have developed two synthetic approaches for several (chiral) phosphanylalkyl or -aryl cyclopentadienyl complexes: a) employing lithium phosphanylalkyl- and -arylcyclopentadienides, such as $\text{Li}[(\text{C}_5\text{H}_4)\text{-X-PR}^1\text{R}^2]$ [$\text{R}^1 = \text{H}$, alkyl, aryl; $\text{R}^2 = \text{alkyl}$, aryl; $\text{X} = \text{alkylene}$, arylene],^[1] as transfer reagents for the organic ligand, and b) by modification of the metal-bound cyclopentadienyl ring in ferrocenes.

Primary (Figure 1) and secondary ferrocenyl phosphines were obtained by method b). These phosphines display interesting reactivity and can be used as starting materials for further functionalisation of the phosphanyl group^[2,3] or for ferrocenyl-substituted P-B-based polymers (Figure 2)^[4].

Tertiary ferrocenyl phosphines, such as 1,2-disubstituted aryl-based ferrocenyl phosphines, have applications in catalytic reactions.^[5] The corresponding 1,1' or 1,1',2-substituted ferrocenes (Figure 3) can be used for immobilisation of the respective ferrocene derivatives, for example on dendrimers.^[6]

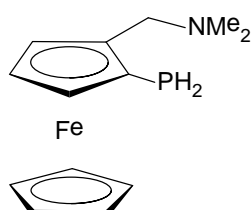


Figure 1

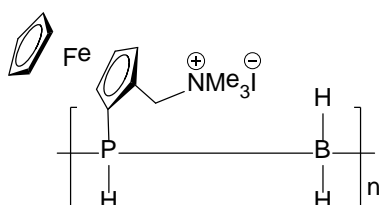


Figure 2

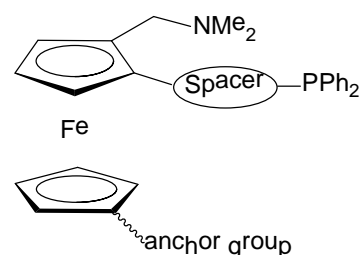


Figure 3

Synthetic routes to these ferrocenyl phosphines,^[2-6] their properties and applications^[7] will be discussed.

Selected References:

- [1] T. Koch, E. Hey-Hawkins, *Polyhedron* **1999**, *18*, 2113.
- [2] S. Tschirschwitz, P. Lönnecke, E. Hey-Hawkins, *Dalton Trans.* **2007**, 1377; S. Tschirschwitz, P. Lönnecke, E. Hey-Hawkins, *Organometallics* **2007**, *26*, 4715.
- [3] C. Limburg, S. Gómez-Ruiz, E. Hey-Hawkins, *Dalton Trans.* **2010**, *39*, 7217; C. Limburg, P. Lönnecke, S. Gómez-Ruiz, E. Hey-Hawkins, *Organometallics* **2010**, *29*, 5427.
- [4] S. Pandey, P. Lönnecke, E. Hey-Hawkins, *Eur. J. Inorg. Chem.* **2014**, 2456.
- [5] M. Madalska, P. Lönnecke, E. Hey-Hawkins, *Organometallics* **2013**, *32*, 2019; M. Madalska, P. Lönnecke, V. Ivanovski, E. Hey-Hawkins, *Organometallics* **2013**, *32*, 5852; V. Ivanovski, M. Bukleski, M. Madalska, E. Hey-Hawkins, *Vibrational Spectroscopy* **2013**, *69*, 57; M. Madalska, P. Lönnecke, E. Hey-Hawkins, *J. Mol. Cat. A: Chemical* **2014**, *383-384*, 137.
- [6] P. Neumann, H. Dib, A.-M. Caminade, E. Hey-Hawkins, *Angew. Chem. Int. Ed.* **2015**, *54*, 311.
- [7] P. Neumann, H. Dib, A. Sournia-Saquet, T. Grell, M. Handke, A.-M. Caminade, E. Hey-Hawkins, *Chemistry A Europ. J.* **2015**, *21*, 6590; J. R. F. Pritzwald-Stegmann, P. Lönnecke, E. Hey-Hawkins, *Dalton Trans.* **2016**, *45*, 2208.