

New perspectives in small molecule activation using low valent main group compounds

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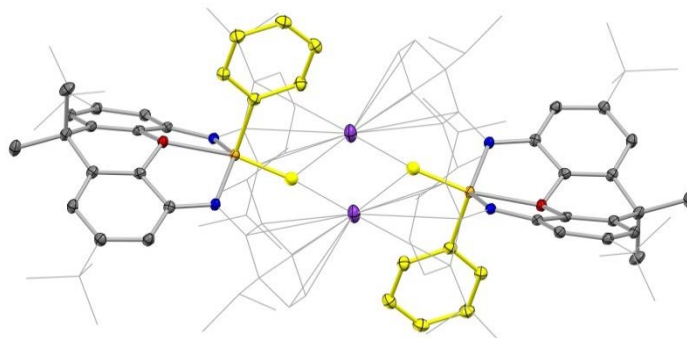
New perspectives in small molecule activation using low valent main group compounds

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The activation and functionalization of chemical bonds represent fundamental processes that underpin chemical synthesis. While such transformations have been exploited in catalysis primarily through the application of late transition ('Noble') metal catalysts, other approaches based on 'base' 3d metals, frustrated Lewis pairs and s-/p-block elements have recently begun to emerge.¹

We have been interested in developing compounds of the group 13 and 14 elements which show unusual electronic structure and/or patterns of reactivity towards E-H bonds (E = H, B, C, N, O, Si). These include highly reactive analogues of carbenes and vinylidenes featuring the heavier group 14 elements,^{2,4} and unusual 5- and 6- valence electron species featuring the Group 13 metals.^{5,6} We have applied these systems to a range of challenging functionalization processes including the activation of 'difficult' E-H bonds (O-H/N-H bonds in water/ammonia, unactivated C-H bonds)^{3,7} and the pairing of oxidative addition processes with subsequent reductive generation of functionalized products.^{3,6}



1. See, for example: P.P. Power, *P.P. Nature*, **2010**, *463*, 171.
2. A.V. Protchenko, K.H. Birjkumar, D. Dange, A.D. Schwarz, D. Vidovic, C. Jones, N. Kaltsoyannis, P. Mountford, S. Aldridge, *J. Am. Chem. Soc.*, **2012**, *134*, 6500.
3. A.V. Protchenko, J.I. Bates, L.M.A. Saleh, M.P. Blake, A.D. Schwarz, E.L. Kolychev, A.L. Thompson, C. Jones, P. Mountford, S. Aldridge, *J. Am. Chem. Soc.*, **2016**, *138*, 4555.
4. A. Rit, J. Campos, H. Niu, S. Aldridge, *Nature Chem.*, **2016**, *8*, 1022.
5. A.V. Protchenko, D. Dange, J. Harmer, C.Y. Tang, A.D. Schwarz, M.J. Kelly, N. Phillips, K.H. Birjkumar, C. Jones, N. Kaltsoyannis, P. Mountford, S. Aldridge, *Nature Chem.*, **2014**, *6*, 315.
6. A.V. Protchenko, D. Dange, A.D. Schwarz, M.P. Blake, C. Jones, P. Mountford, S. Aldridge, *J. Am. Chem. Soc.*, **2014**, *136*, 10902.
7. J. Hicks, P. Vasko, J.M. Goicoechea, S. Aldridge, submitted.



Simon ALDRIDGE (47) is professor of chemistry at the University of Oxford. Originally from Shrewsbury, England, he received both his BA and DPhil degrees from the University of Oxford, the latter in 1996 for work on hydride chemistry under the supervision of Tony Downs. After post-doctoral work as a Fulbright Scholar at Notre Dame with Tom Fehlner, and at Imperial College London (with Mike Mingos) he took up his first academic position at Cardiff University in 1998. He returned to Oxford in 2007, being promoted to full professor in 2010. Prof Aldridge has published more than 190 papers to date and is a past winner of the Dalton Transactions European Lectureship and the Royal Society of Chemistry's Main Group Chemistry Award.