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Taming of deadly white phosphorous

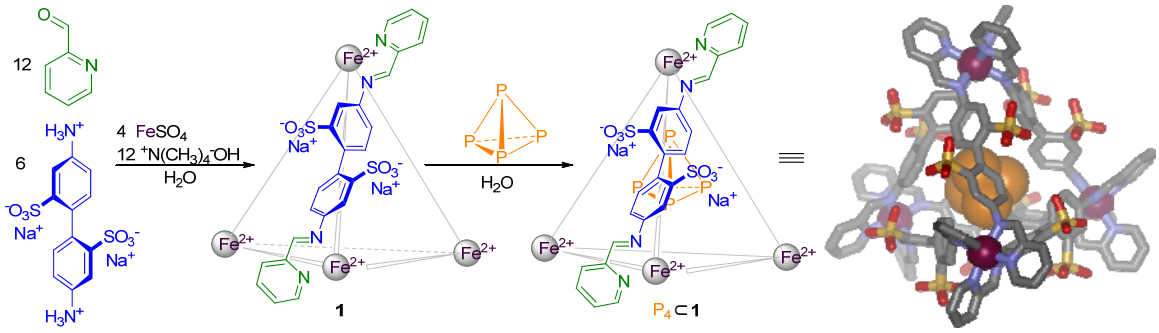

Figure 1. Synthesis of tetrahedral cage **1** and subsequent incorporation of $\mathbf{P_4}$; Crystal structure of $\mathbf{P_4}\subset\mathbf{1}$. Solvent molecules, counter ions and hydrogen atoms are omitted for clarity. Fe violet, N blue, C gray, O red, S yellow, P orange.

For centuries, because of its propensity to burst into flame, white phosphorous has often been used on the battlefield to create smokescreens and as an incendiary substance in bombs and artillery and mortar shells. But the chemical also has a useful application as a component of weed killers, insecticides and fertilisers, making its safe storage and transport critically important for industry.[1] Recently, a research team consisting of Prasenjit Mal, Boris Breiner and senior author Jonathan Nitschke at the University of Cambridge's Department of Chemistry, together with Kari Rissanen from the University of Jyvaskyla in Finland revealed that they have tamed white phosphorus.[2] They have created a 'container molecule' to stabilise white phosphorous indefinitely. This renders it safe until such time as a signal agent, benzene, is applied to release it. Their work could also result in an array of hazardous chemicals being handled and transported more safely in future.

The practical implications of the research are impressive: the technique of 'caging' individual molecules of the substance allows it to be manipulated and stored with greater safety, and has the potential to be used to tame other dangerous chemicals.

The use of the EPSRC Swansea mass spectrometric facility was crucial in characterising new ligands and their various precursors, and molecular metal-ligand complexes as building blocks to these cage molecules as well as the characterisation of host-guest complexes.[3]

1. "White phosphorus is air-stable within a self-assembled tetrahedral capsule" P. Mal, B. Breiner, K. Rissanen and J.R. Nitschke *Science* **2009**, *324*, 1697-1699.
2. "Interplay of interactions governing the dynamic conversions of acyclic and macrocyclic helicates" V.E. Campbell, X. de Hatten, N. Delsuc, B. Kauffmann, I. Huc and J.R. Nitschke *Chem. Eur. J.* **2009**, *15*, 6138-6142.

[1] Raymond, K. N. *Nature* **2009**, *460*, 585–586.
[2] Mal, P.; Breiner, B.; Rissanen, K.; Nitschke, J. R. *Science* **2009**, *324*, 1697–1699.
[3] Mal, P.; Schultz, D.; Beyeh, K.; Rissanen, K.; Nitschke, J. R. *Angew. Chem. Int. Ed.* **2008**, *47*, 8297–8301.