RECENT ADVANCES IN PHOSPHORUS CHEMISTRY

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In this lecture some of the most recent achievements in the field of the chemistry of elemental phosphorus, deriving from the author's own research in Florence (Italy) during the last two decades, will be presented and discussed.

The lecture will encompass the three allotropes of elemental phosphorus with particular emphasis to the extremely reactive and toxic white allotropic form and, on the opposite end, to the incredibly inert black allotrope. More in details, the lecture will include:

i) the ruthenium mediated activation of white phosphorus pointing out the unusual and fascinating hydrolytic degradation of the P4 molecule which follows its η1-coordination to the metal. The stepwise hydrolysis results in a variety of unusual Px fragments ($x \leq 4$), such as P-oxyacids, mono-, di-, and triphosphanes and hydroxyphosphanes, stabilised by coordination to one or two metal centers;[1]

ii) our most recent results in the chemistry of the less reactive allotrope of the element, i.e. black phosphorus, which may be easily exfoliated to form 2D-flakes of phosphorene (the all-P analogue of graphene).[2] This new material exhibits intriguing electronic properties and behaves as a perfectly tailored platform to host transition-metal nanoparticles[3] and, likely, to coordinate different transition metal fragments.[4,5]

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3. M. Caporali, M. Serrano-Ruiz, F. Telesio, S. Heun, G. Nicotra, C. Spinella, S. Caporali, M. Peruzzini Chem. Commun. 2017, 53, 10946 – 10949.
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5. For a theoretical analysis of the bonding capabilities of phosphorene see: A. Ienco, G. Manca, C. Mealli, M. Peruzzini Dalton Trans. 2018, 47, 17243 – 17256.