Advances in P-based Molecular Materials for Optoelectronics

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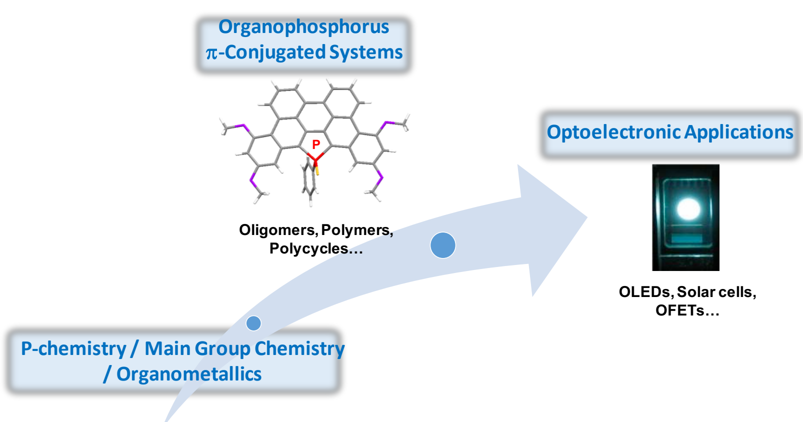
Since the pioneering work of Shirakawa, Heeger, and McDiarmid in the 1970s, the interest for organic π-conjugated systems has grown tremendously. Indeed organic materials offer the possibility to process light-weight, flexible electronic devices, however, they have to satisfy a large number of technical requirements in order to be stable and efficient in the device. The insertion of a heteroelement into the backbone has appeared as an appealing way to tune the properties of the materials. Heterocycles like thiophene, pyrrole, and their derivatives are now widely used to modify chemical and physical properties of π-conjugated systems. Interestingly, while organophosphorus derivatives have been investigated for decades, their insertion into devices has only been achieved recently. The high reactivity and toxicity of many P-derivatives are one of the reason but the ability of chemists to stabilize and protect the P-atom allowed the introduction of organophosphorus derivatives into optoelectronic devices. Here, we will report on phosphorus-based molecular materials: their synthesis, their unique properties useful for organic electronic materials, and the devices that they have been incorporated in so far.



For example, we have shown that phosphorus heterocycles (phosphete, phosphole, phosphinine, phosphepine…) are appealing building blocks for the construction of π-conjugated systems. Effectively, the reactivity of the P-center allows a straightforward HOMO-LUMO gap tuning as evidence by photophysical and electrochemical studies. The coordination ability of the P-center allows unprecedented coordination-driven assembly of π-systems onto transition metals. All these physical properties make phosphorus heterocycles valuable building blocks for the development of material for optoelectronics.

References:

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[2] M. P. Duffy, W. Delaunay, P.A. Bouit, M. Hissler, *Chem. Soc. Rev.* **2016**, **45, 5296.**