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# Advanced Phosphorus Chemistry for Application in Catalysis and Optoelectronic

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Organophosphorus compounds have a central role in modern chemistry in particular as ligands for coordination chemistry and for the development efficient homogeneous or heterogeneous catalysts (including asymmetric catalysts).<sup>[1]</sup> In addition the development of phosphorus-based organocatalysts has become very popular over the past years.<sup>[2]</sup>

Among these compounds, tertiary phosphines play a pivotal role in the growing use of organophosphorus compounds. Their synthetic accesses often require the use of metal phosphides or organometallic reagents thus generating quantities of unwanted wastes. Very recently, we have shown that a large range of novel tertiary diphenylphosphine derivatives can be readily obtained in high yield through a novel and straightforward reaction pathway.<sup>[3,4]</sup> Our first investigations on the properties of these new molecules revealed that they offer many opportunities for the development of novel advanced catalysts and novel materials (including luminescent materials) for applications including optoelectronic.

The aim of the thesis is to investigate the scope of these new synthetic pathways to further develop novel and unprecedented phosphine-based materials and to investigate their coordination chemistry (Cu, Pd, Pt, etc.). In addition, the candidate will have to study the properties of these new materials for potential applications, such as in catalysis or as additives for devices such as OLEDs. He/she should have a strong interest in transition metal chemistry and their applications.

## References

[1] (a) R. Martin and S. L. Buchwald, *Acc. Chem. Res.*, 2008, **41**, 1461–1473; (b) *Phosphorus(III) Ligands in Homogeneous Catalysis: Design and Synthesis*, ed. P. C. J. Kamer and P. W. N. M. van Leeuwen, Wiley, 2012, pp. 355–389. (c) *Phosphorus Ligands in Asymmetric Catalysis: Synthesis and Applications*, ed. A. Börner, Wiley-VCH, Weinheim, 2008. (d) *Privileged Chiral Ligands and Catalysis*, ed. Q.-L. Zhou, Wiley-VCH, Weinheim, 2011.

[2] H. C. Guo, Y. C. Fan, Z. H. Sun, Y. Wu and O. Kwon, *Chemical Reviews*, 2018, **118**, 10049-10293.

[3] D. Bissessar, J. Egly, T. Achard, S. Bellemin-Laponnaz, *Green Chem.* **2019** submitted for publication.

[4] Patents:

(a) S. Bellemin-Laponnaz, D. Dissessar, P. Steffanut, « Tetra-nuclear neutral copper (I) complexes » EP 18 178 819 **2018**.

(b) S. Bellemin-Laponnaz, D. Dissessar, J. Egly, P. Steffanut, « Tetra-nuclear neutral copper (I) complexes with diaryl-phosphine ligands » EP 18 178 816 **2018**.

(c) S. Bellemin-Laponnaz, D. Dissessar, T. Achard, P. Steffanut, « Phenylphosphino Compounds as Process Stabilizers » EP 18 178 820.9 **2018**.