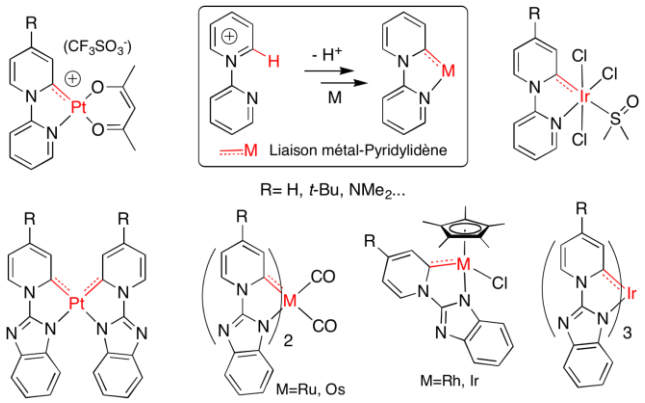
Beyond Conventional Ligands: Pyridylidenes and Their Organometallic Complexes for Emerging Applications

Jamal Moussa *et al.*
Sorbonne Université – Institut Parisien de Chimie Moléculaire UMR 8232 – Paris, France. jamal.moussa@sorbonne-universite.fr

Abstract

Metal complexes of N-Heterocyclic carbenes (NHC) have found a plethora of applications in the last two decades following the seminal work of several groups. This contrasts with the underexplored pyridylidene category.[1] Pyridylidenes exhibit a higher σ-donor and π-acceptor character than imidazolylidenes, thus pyridylidenes are attractive ligands to promote organic transformations or light emission in the related transition metal complexes. Pyridylidenes remain scarcely investigated certainly due the absence of general methods for accessing pyridylidene-based metal complexes. Only few specific routes were reported to date. In this context our research investigations describe the development of several methods for the synthesis of organometallic compounds containing pyridylidene ligands with transition metals such as Ru(II), Os(II), Rh(III), Ir(III) and Pt(II).[2-5] More recently, earth-abundant transition metals such as Mn(II), Fe(II), Ni(II) and Co(III) are also prepared with exceptionally unprecedented properties. In particular, some of the complexes obtained exhibit strong phosphorescence in the solid state which makes them attractive candidates as doping materials in OLEDs to harvest the triplet excitons. Some of the non-metallated compounds exhibits TADF (Thermally Activated Delayed Fluorescence) which is of high interest in the third generation of OLED emitters. Moreover, our novel compounds also show interesting NLO,[6] reactivity,[7] catalytic, biological and properties that are investigated in collaboration with several research groups. During this presentation, the development of new methodologies to obtain our novel materials as well as their photoluminescent properties will be presented.

Figure: Archetypal structures of prepared compounds with pyridylidene ligands



Recent Publications

1. S. S. Jamil, J. Moussa *Coord. Chem. Rev.* **2025**, *538*, 216600
2. A. Hassoun, A. Benchohra, O. Khaled, D. Seghouane, J. Moussa *Monatshefte fuer Chemie* **2020**, *151*, 799
3. J. Moussa, G. R. Freeman, J. A. Gareth Williams, L.-M. Chamoreau, P. Herson, H. Amouri *Eur. J. Inorg. Chem.* **2016**, 76
4. J. Montagu, G. Gontard, J. A. G. Williams, J. Moussa *Eur. J. Inorg. Chem.* **2023** e202300487
5. D. Amelot, J. P. Calupitan, J. Moussa, G. Frison *ChemPhotoChem* **2025**, *9*, e202500130
6. S. Taboukhat**,** C. Wu, D. Amelot, D. T. Pham, S. S. Jamil, A. El-Ghayoury, J. Moussa, A. Kityk, B. Sahraoui *J. Phys. Chem. C* **2025**, *129*, 22590-22598
7. D. T. Pham, J. P. Calupitan, G. Gontard, L. Sosa Vargas, F. Mathevet, R. Kinjo, J. Moussa *Org. Lett.* **2026**, *28*, 903-906

Biography



Dr. Moussa obtained a PhD from Université Pierre et Marie Curie (UPMC), in Paris, France in 2007 working on the synthesis of luminescent transition metal complexes. He then moved to ETHZ for a two-year postdoctoral stay in the group of Antonio Togni working on the use of ferrocenyl based NHC ligands for asymmetric catalysis. He was then appointed an assistant professor position in 2009 at UPMC. In 2023 he defended the Habilitation to direct researches as associate professor at Sorbonne Université, Paris. He is involved in several strong international collaborations (Prof. C. Adachi Kyushu U., Japan; Prof. R. Kinjo, NTU Singapore; Prof. P. Harvey, Sherbrooke U. Canada; Prof. S. Panda, IIT Kharagpur, India; Prof. A. Mondal, IISc Bangalore, India; Prof. H. Hashimoto, Tohoku U., Japan).
https://scholar.google.com/citations?user=GJ5mgPYAAAAJ&hl=en