Impact of the Use of Sterically Congested Luminescent Iridium(III) Complexes on the Photoluminescent Properties

Claus Hierlinger,[1,2] Eli Zysman-Colman,[1] Véronique Guerchais[2]

[1] Organic Semiconductor Centre, EaStCHEM School of Chemistry North Haugh, University of St Andrews, St Andrews, Fife, UK KY16 9ST

[2] UMR 6226 CNRS - University of Rennes I, Institut des Sciences Chimiques de Rennes, Campus Beaulieu, Rennes. France

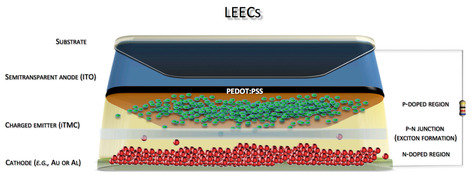
claus.hierlinger@univ-rennes1.fr

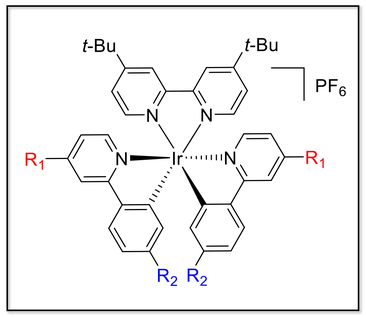
Since its invention, artificial lighting has influenced tremendously human activity, particularly as it allows society to become productive in the absence of daylight. The quality of light, the performance and the energy efficiency have been steadily improving, with OLEDs (organic light emitting diodes) emerging as one of the state-of-the-art artificial lighting technologies. However, OLEDs suffer from issues such as high production costs and small active surface areas. Another promising artificial light technology is the light emitting electrochemical cell (LEEC), with an emitter based on luminescent cationic iridium complexes. This device possesses a simpler architecture, which can lower significantly the production costs.

Objectives: Design a family of cationic Ir(III) complexes by modulating the size of the hydrophobic, bulky substituents R_1 and R_2 on the C^N ligands. These groups will:

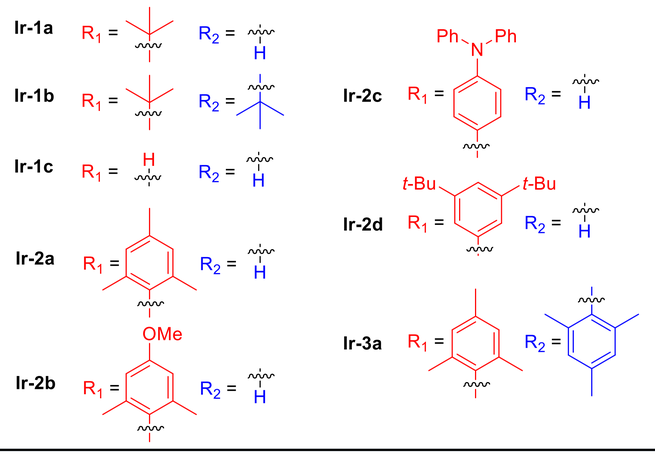
- hinder disadvantageous attack by small molecules in the film
- increase inter-nuclear dsistances
- impede excited state self quenching

→Leading to enhanced performance of the LEECs

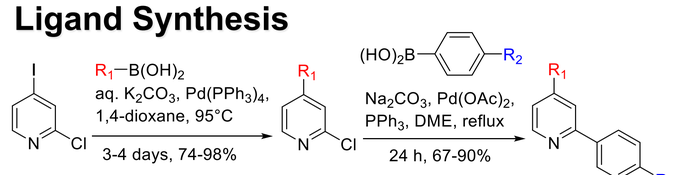


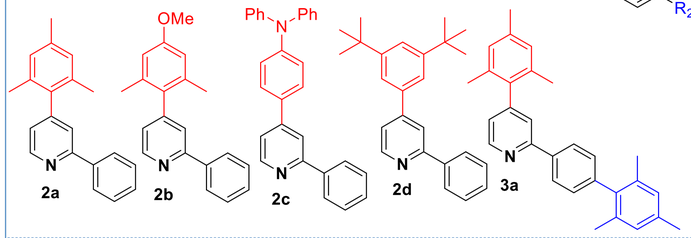


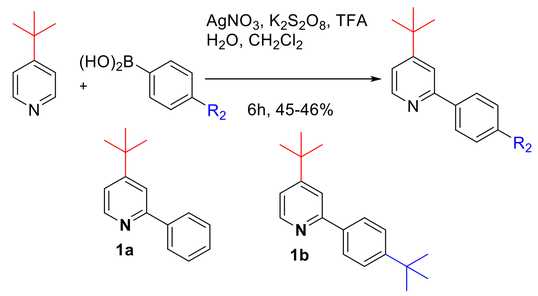
Target cyclometalated cationic Ir(III) complexes



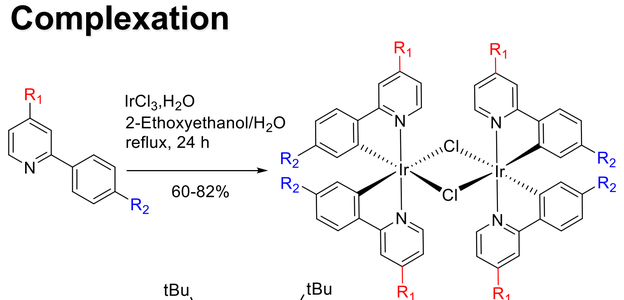
Ligand Synthesis

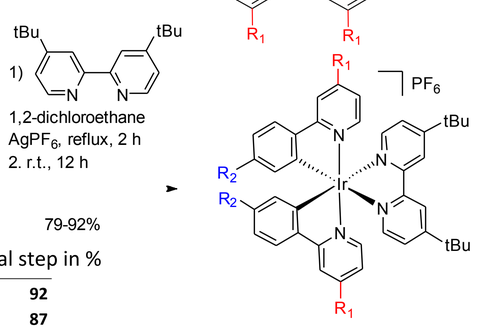






Complexation



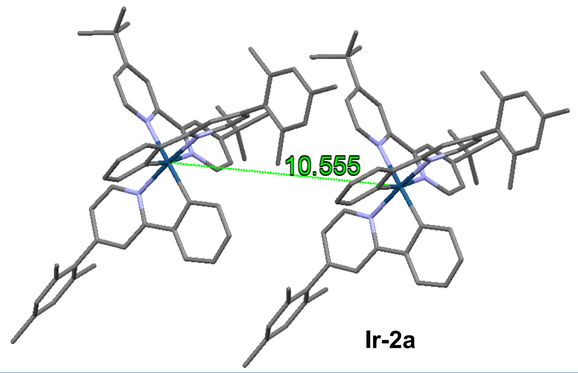


Yield of final step in %

Ir-1a	92
Ir-1b	87
Ir-2a	81
Ir-2b	79
Ir-3a	85

- synthesized Ir(III) complexes

X-ray structures



Ir-2a

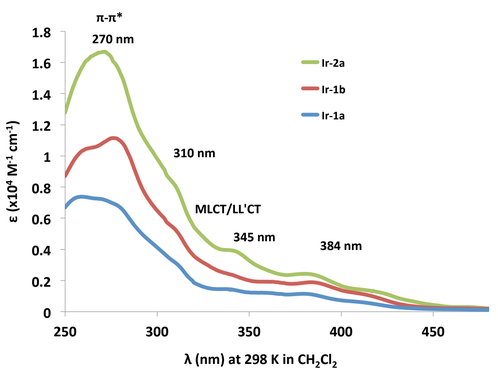
Ir···Ir distances (Å)

Ir-1a	7.243
Ir-1b	10.710
Ir-2a	10.555
Ir-2b	10.630
Ir-3a	10.401

Shortest Ir···Ir distances in crystal packing

Preliminary Photophysical Data

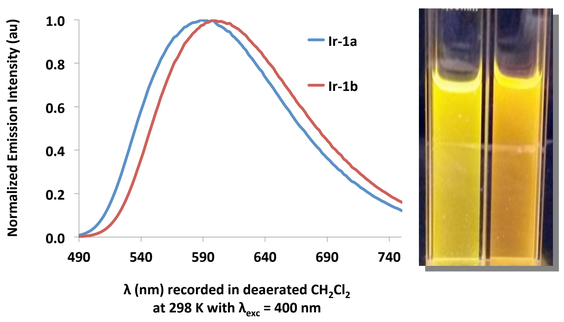
UV-Vis Absorption Spectra



	λ_{max} (nm)	Φ_{PL} (%)	τ (ns)
Ir-1c[1]	581	24	557
Ir-1a	590	34	770
Ir-1b	598	32	477

[1] Data in MeCN. *J. Am. Chem. Soc.*, **2004**, *126*, 2763

Emission studies



Conclusions

- Successful synthesis in good yields of a new family of cationic Ir(III) complexes (confirmed by NMR, MS and X-ray)

- Preliminary results of photophysical studies show red shift in emission by adding more bulky, electron donating substituents on C^N ligand

Perspectives

- Investigation of these sterically congested Ir(III) complexes in solution, solid state and films in order to ascertain how Φ_{PL} and τ_e are impacted.

- Preparation of LEECs with synthesized complexes as the emissive layer