

Impact of the Use of Sterically Congested C^N Ligands on the Photoluminescent Properties of Iridium(III) Complexes

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INTRODUCTION

Since the invention of artificial light, the quality, the performance and the energy efficiency of luminaires have been steadily improving, with organic light emitting diodes (OLEDs) 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 lighting technology is the light emitting electrochemical cell (LEEC), with an emissive layer based on luminescent cationic iridium complexes. This device possesses a simpler architecture, which can lower significantly the production costs. Excited state self-quenching during the operation can limit the lifetime of the device. A strategy to circumvent this issue is to control the inter-nuclear distance by decorating the complexes with bulky, hydrophobic substituents.

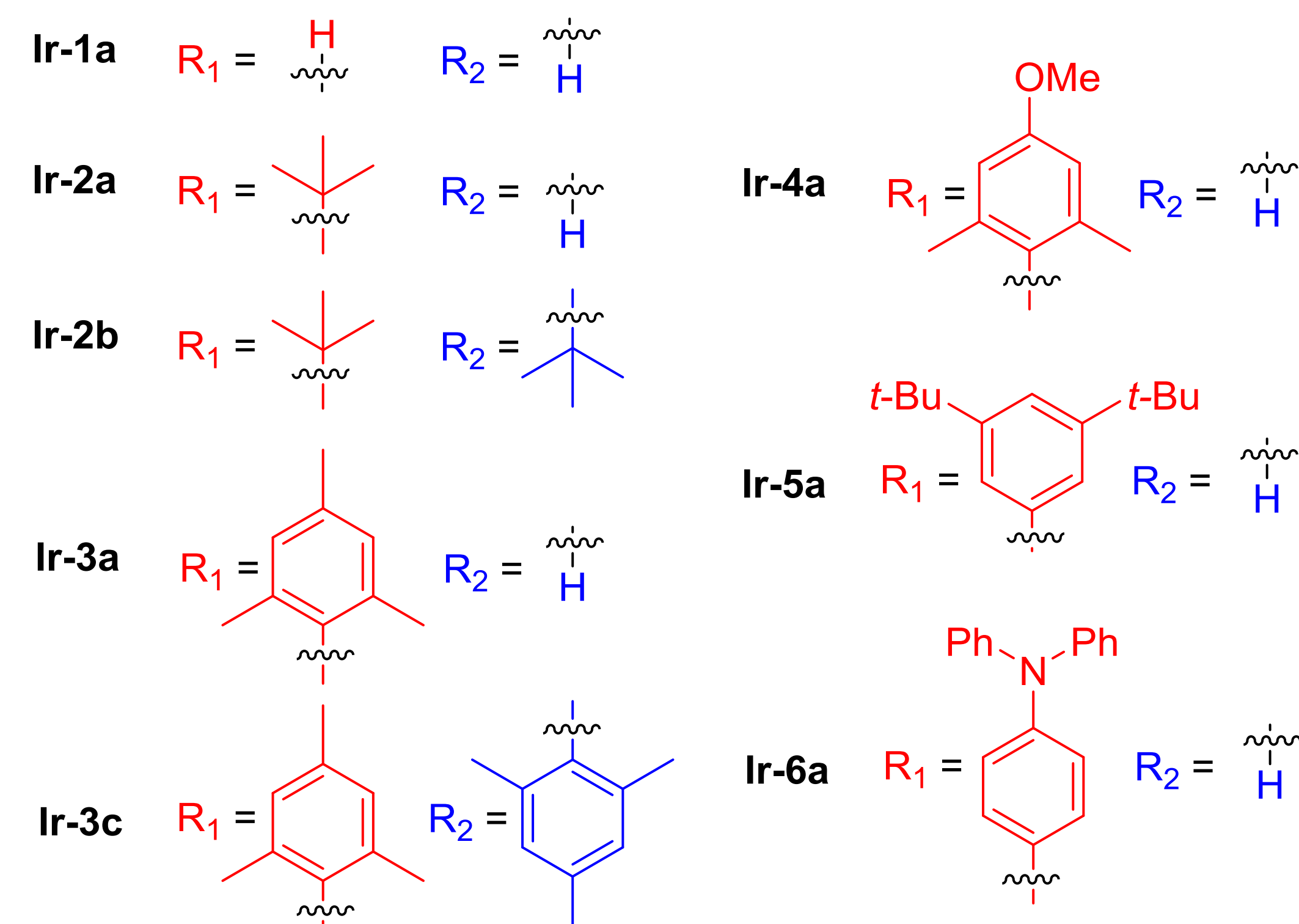
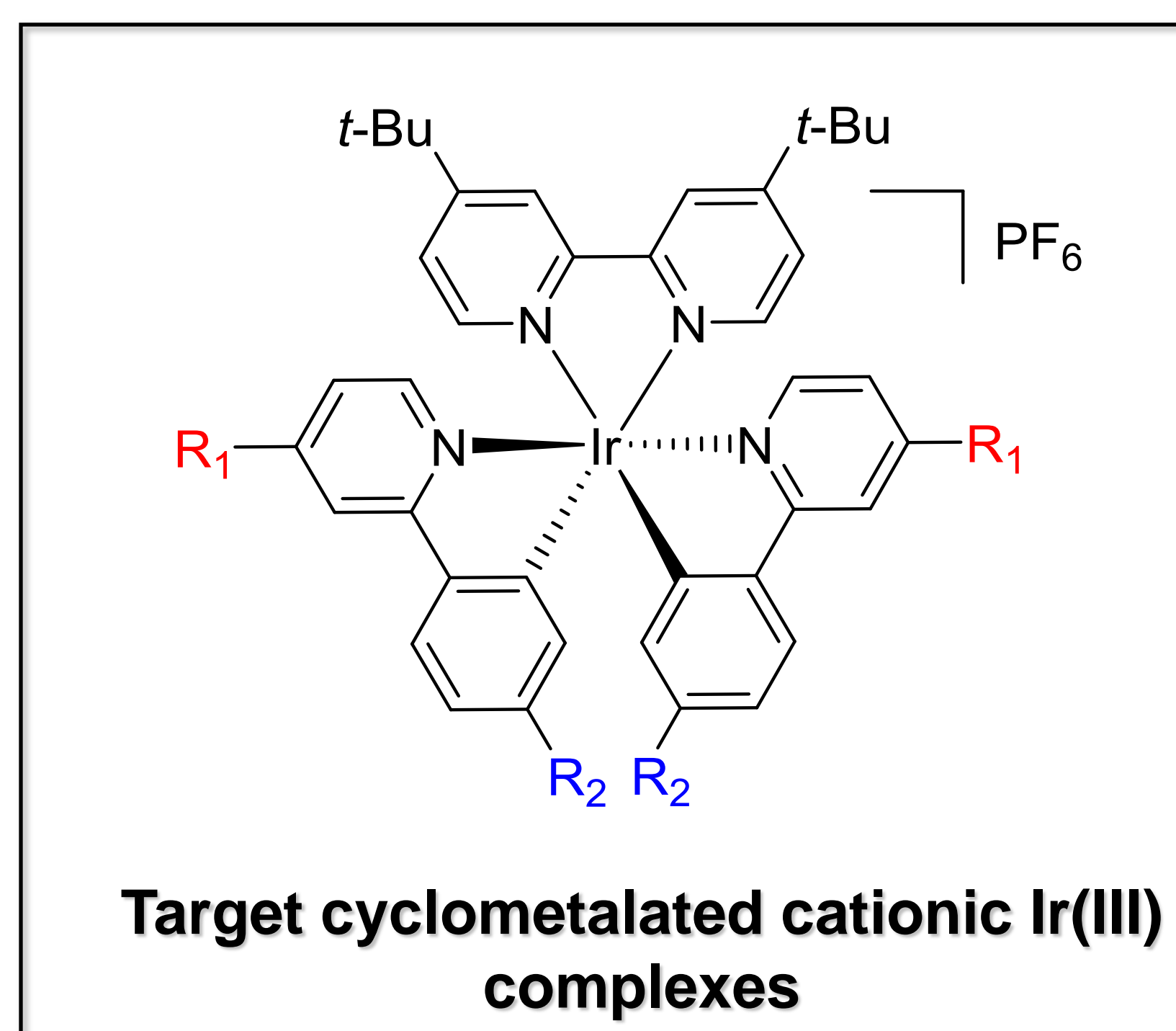
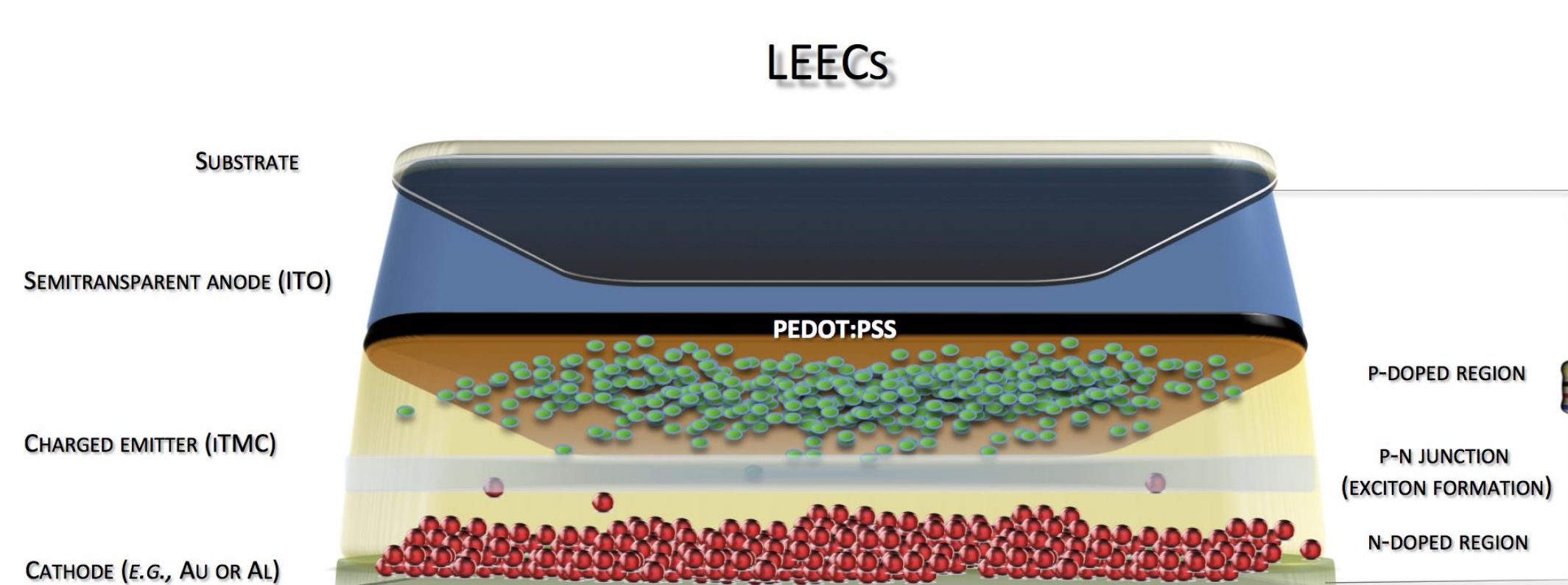
OBJECTIVES

Design a family of cationic Iridium(III) complexes by modulating the size of substituents R_1 and R_2 on the C^N ligands.

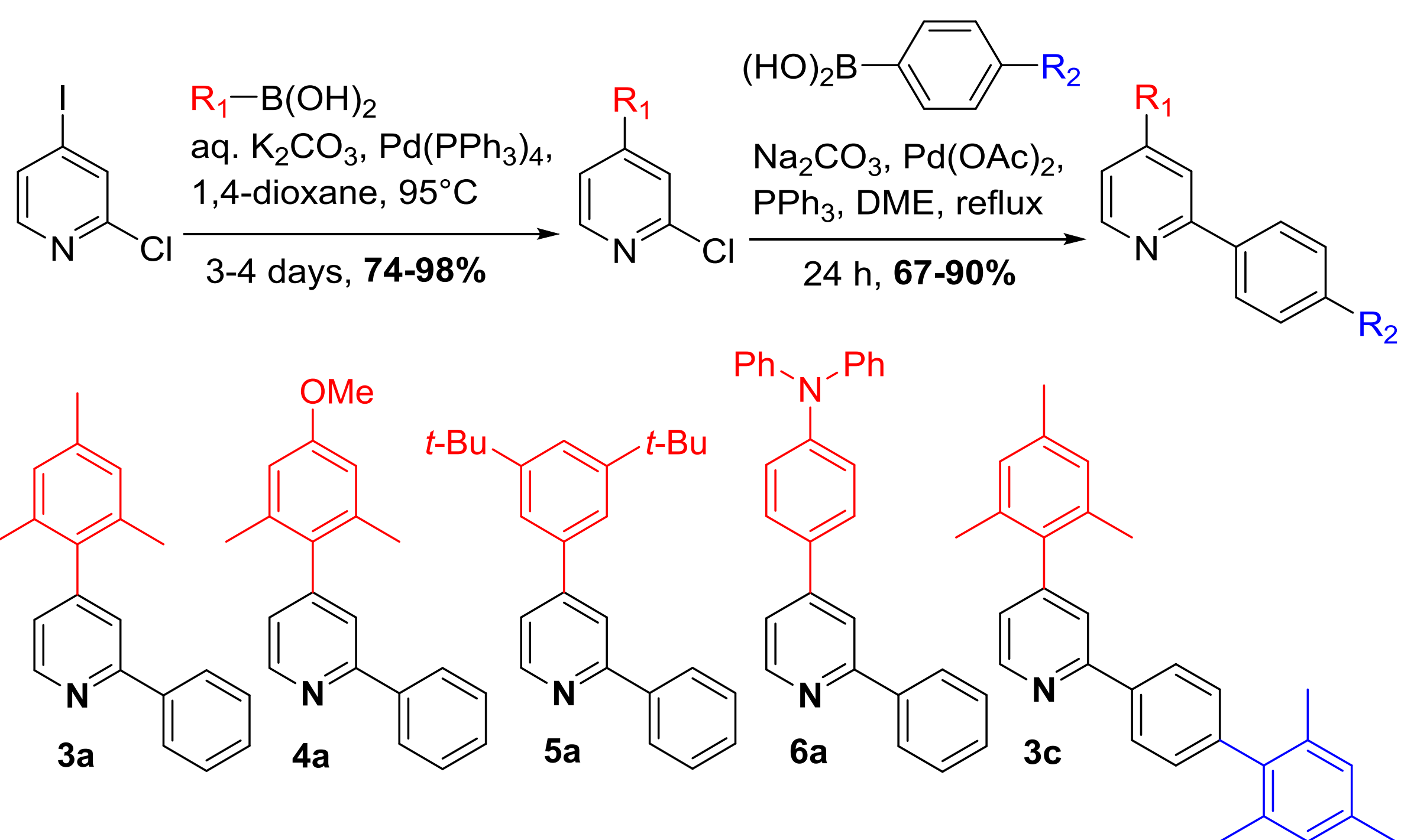
These groups will:

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

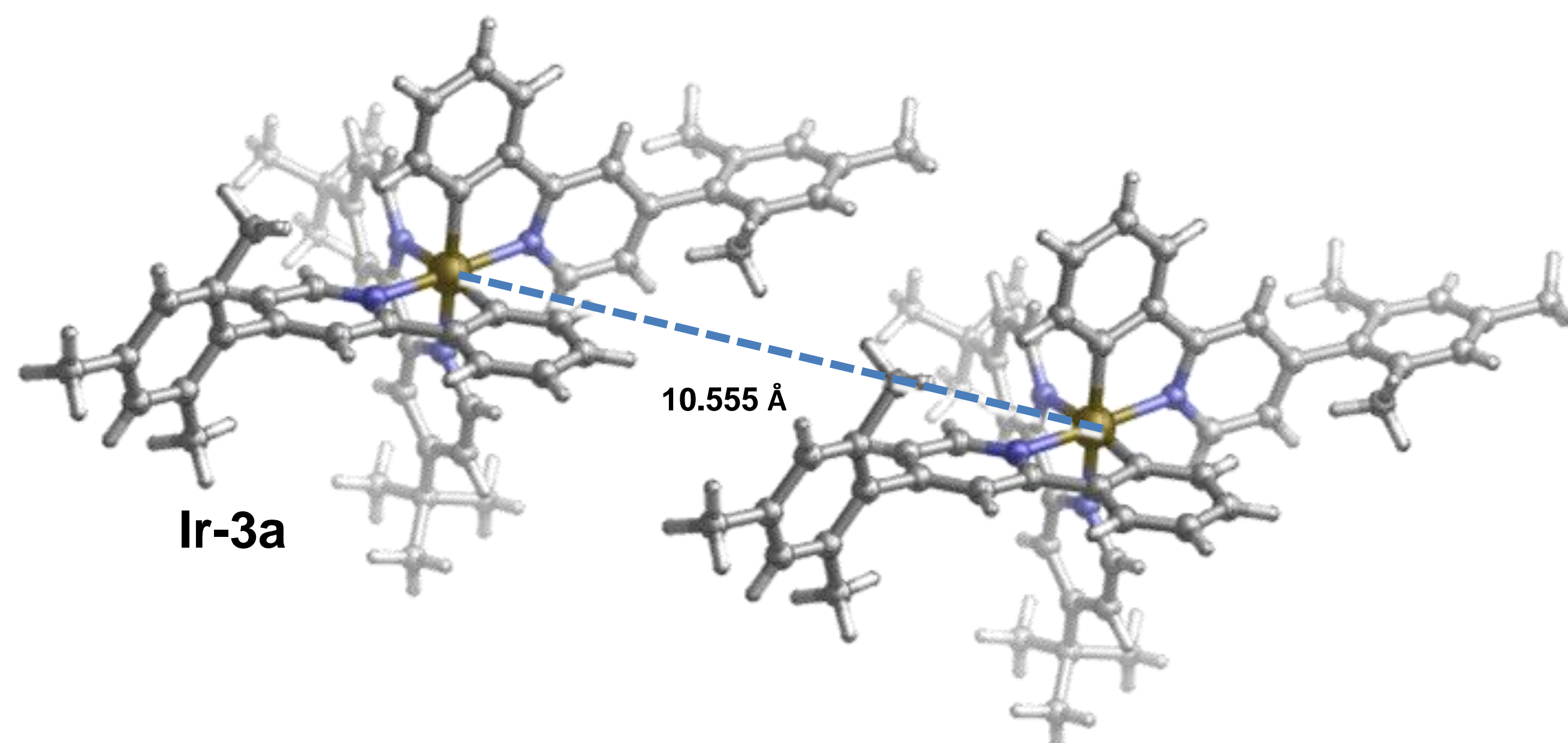
→ Leading to enhanced performance of the LEECs



LIGAND SYNTHESIS



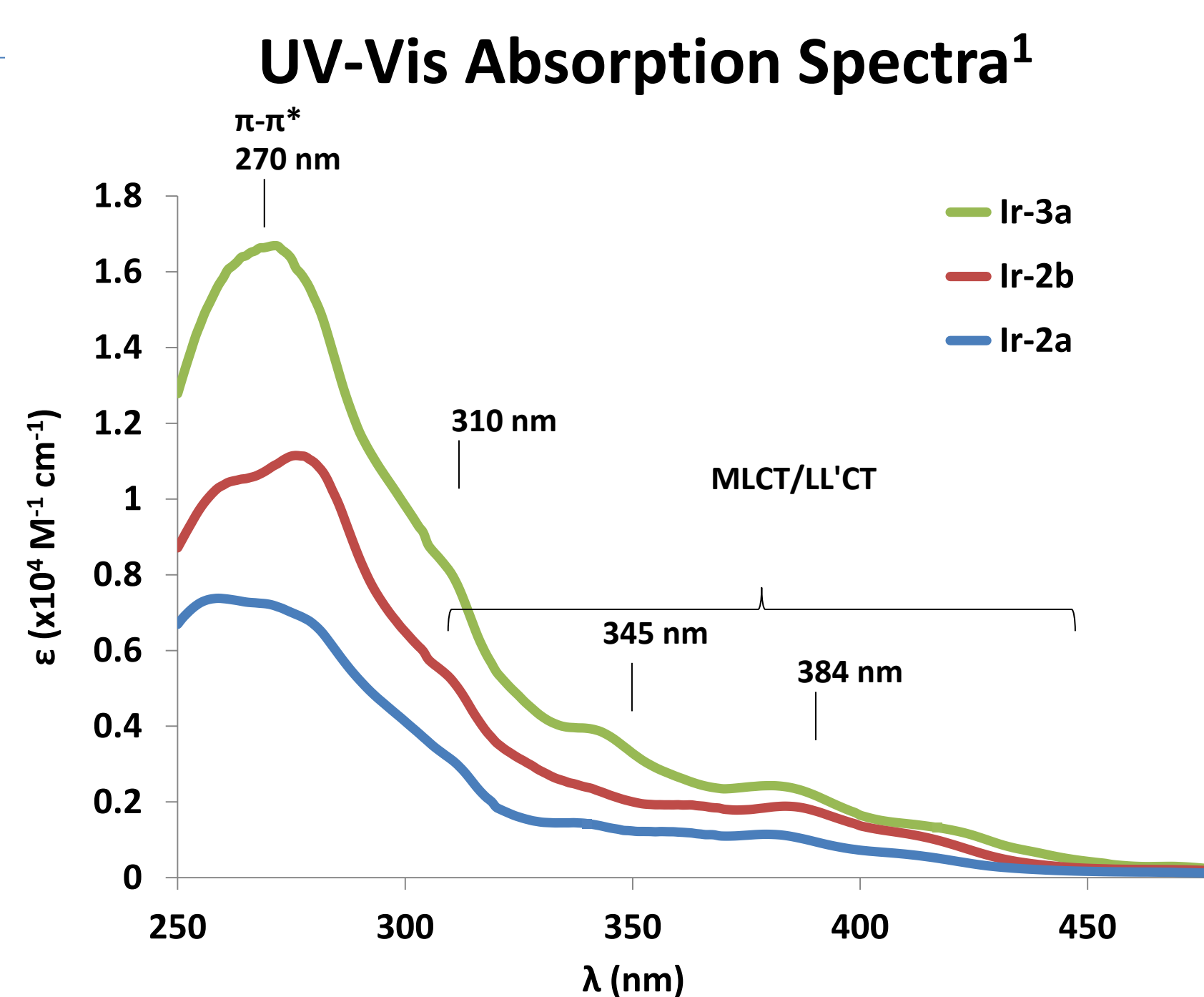
X-RAY STRUCTURES



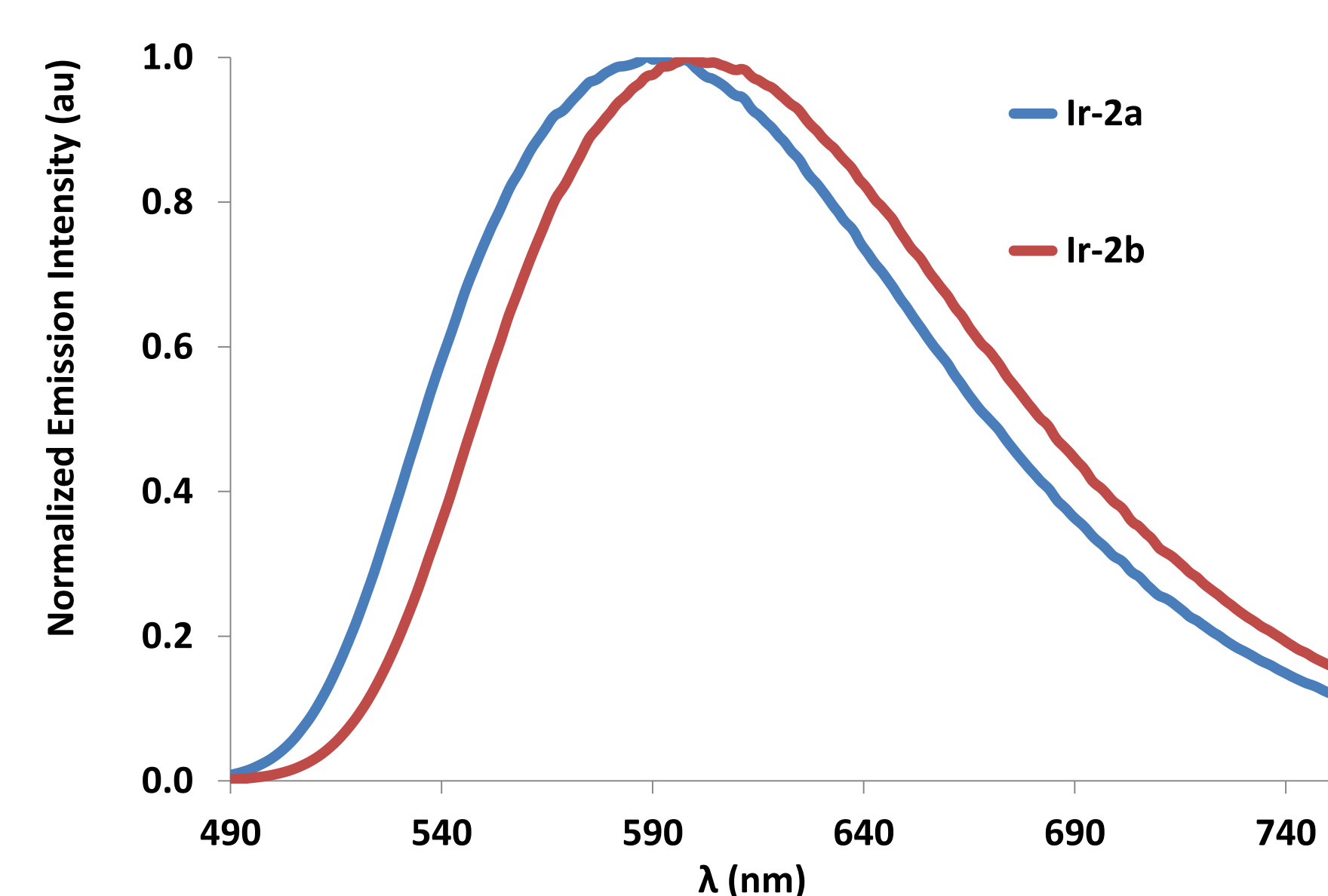
Ir...Ir distances (Å)

Ir-2a	7.243
Ir-3c	10.401
Ir-3a	10.555
Ir-4a	10.630
Ir-2b	10.710

PRELIMINARY PHOTOPHYSICAL DATA



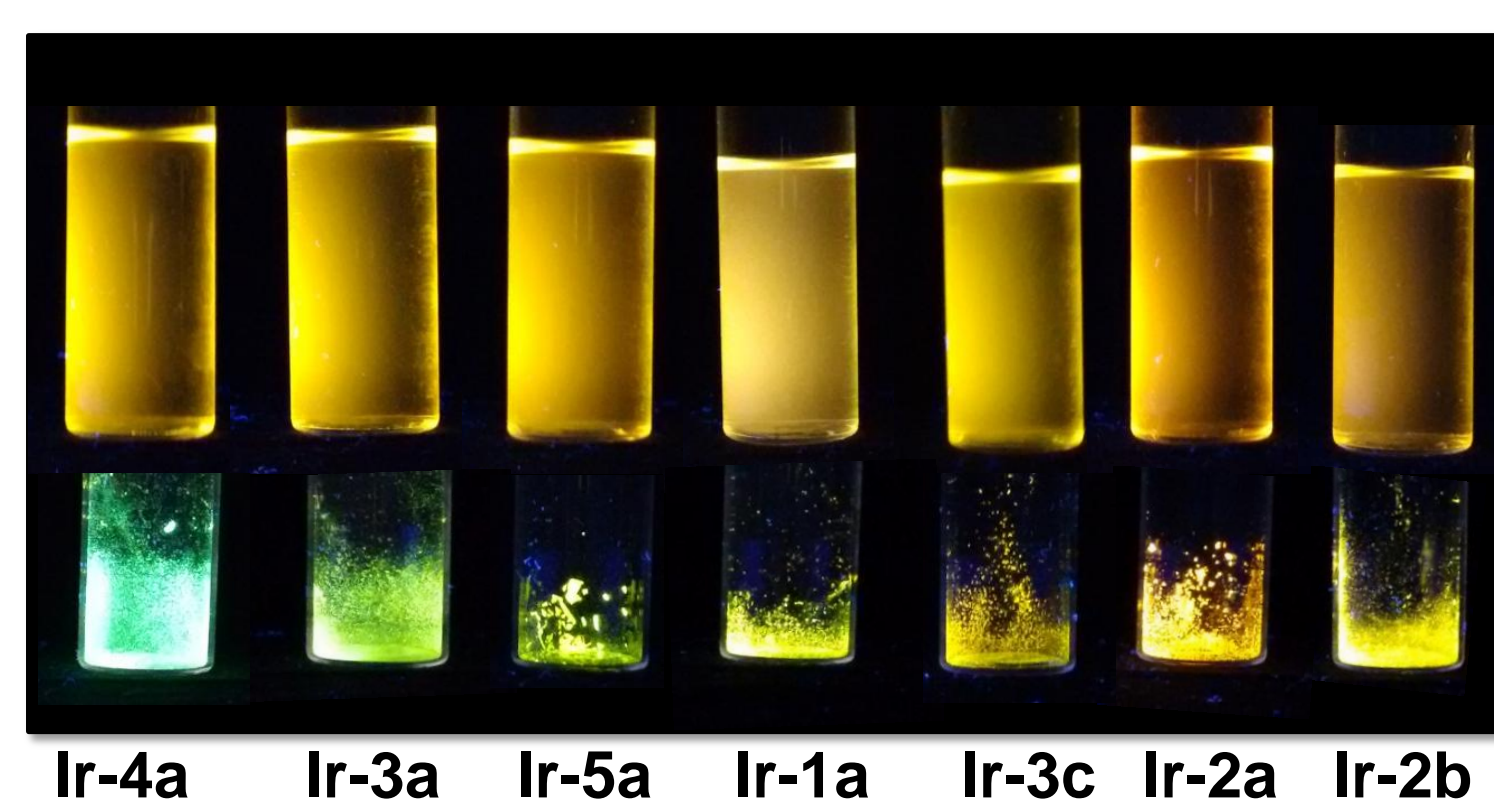
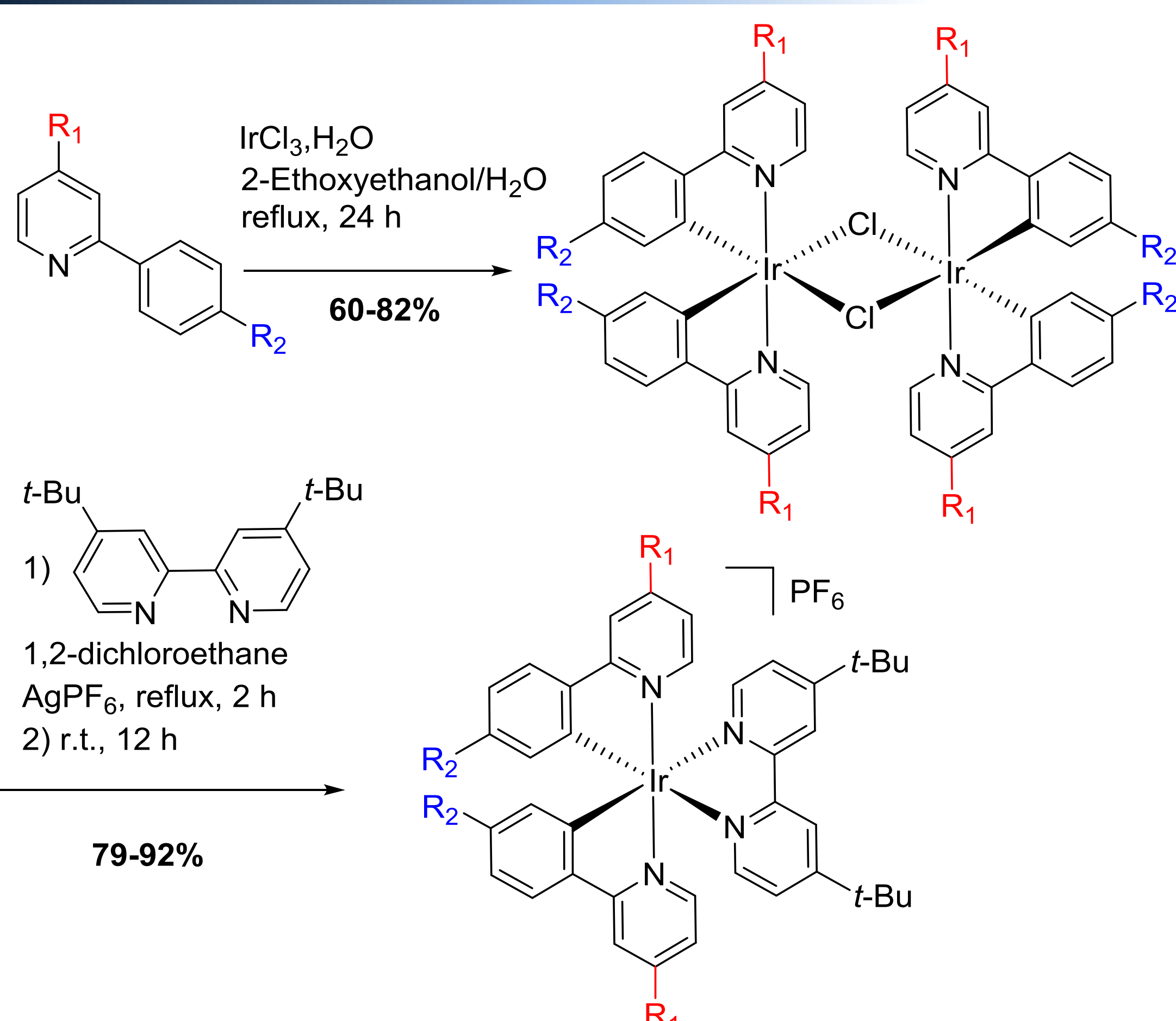
Emission studies²



	λ_{max} (nm)	Φ_{PL} (%)	τ (ns)
Ir-1a ³	581	24	557
Ir-2a	590	34	770
Ir-2b	598	32	477

¹in CH_2Cl_2 , at 289 K, ²recorded in deaerated CH_2Cl_2 , at 298 K with $\lambda_{\text{exc}} = 400$ nm, ³Data in MeCN. *J. Am. Chem. Soc.*, 2004, 126, 2763

COMPLEXATION



CONCLUSIONS

- Successful synthesis in good yields of a new family of cationic Ir(III) complexes.
- Preliminary results of photophysical studies show red shift in emission by adding more bulky, electron donating *tert*-butyl substituents on C^N ligand.

PERSPECTIVES

- Completion of the investigation of these sterically congested Ir(III) complexes in solution and thin films in order to ascertain how Φ_{PL} and τ_e are impacted.
- Preparation of LEECs with synthesized complexes as the emissive layer.

ACKNOWLEDGEMENTS AND FUNDING