

# Synthesis of Luminescent PMO hybrid material using an Iridium centred Inorganic dye.

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## 1. Introduction and Aims:

Organic-Inorganic mesoporous hybrid materials has a huge potential number of applications throughout many areas of research due to their robustness and ability to be modified with organic functionality for further chemistry. During my research project I was tasked with a main objective synthesising a periodic mesoporous organosilicate (PMO) system with a photosensitized Iridium based inorganic dye and investigate its altered photo-physical properties due its incorporation in the PMO system using UV-Visible spectroscopy to measure the absorption and emission spectra of the free dye and when incorporated into the PMO.

## 2. Importance

Hybrid materials such as PMO can house molecules either in the pores of the silicate (see reaction scheme) or be directly incorporated into the silicate structure, both of which alter the photo-physical properties of the molecule. Additionally hybrid materials offer other advantages such as:

- More robust and thermodynamically stable systems.
- Avoid light scattering present in solid state systems.
- Tuneable environments to house molecules.

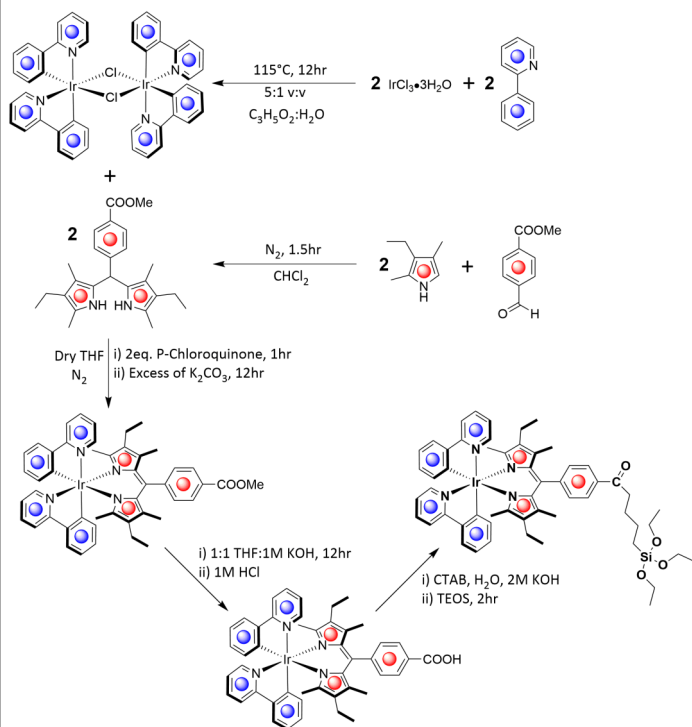
## 3. Method and experimental procedure:

Initially the Iridium precursor was made by reacting  $\text{IrCl}_3 \cdot 3\text{H}_2\text{O}$  and 2-phenylpyridine in a methoxyethanol/water (5:1 v:v) mixture to yield a yellow solid.

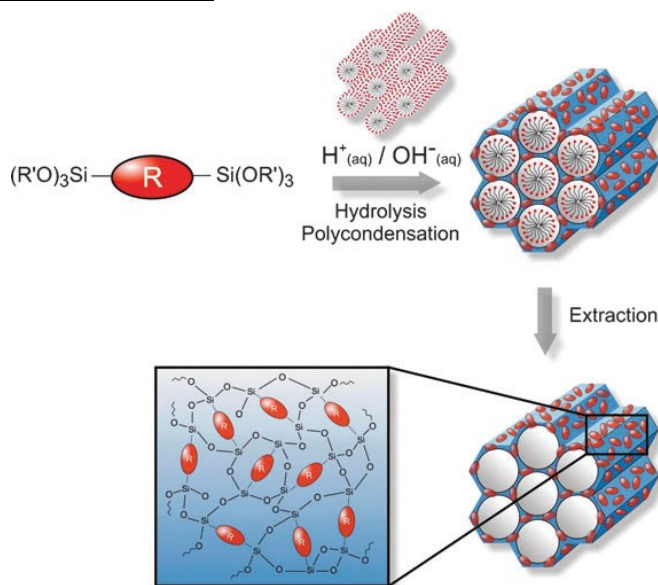
The dipyrromethane ligand was then synthesised by adding methyl-4-formylbenzoate to a stirred solution of 2,4-dimethyl-3-ethylpyrrole in Dichloromethane (DCM) under an inert atmosphere, yielding a viscous red oil. The Iridium precursor was then complexed with the ligand using p-chloroquinone under an inert atmosphere using tetrahydrofuran as the solvent. The resulting mixture contained the target dye;  $[\text{Ir}(\text{ppy})_2(\text{dipy})]$ .

Finally the ester group on the dipyrromethane ligand was hydrolysed to form the carboxylic acid adduct of the dye. Unfortunately due to low yields

## 4. Reaction scheme



## PMO synthesis scheme

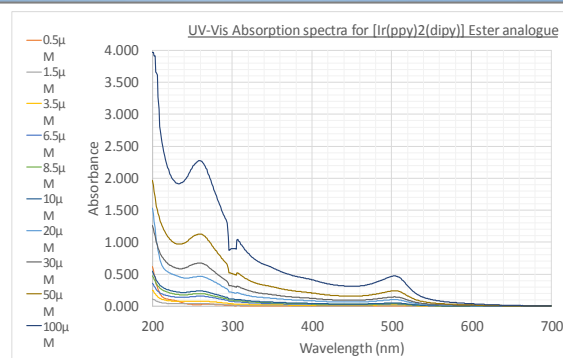


(Diagram adapted from reference<sup>2</sup>)

## 5. Results and Discussion

As previously mentioned the PMO synthesis was not completed due to timing constraints. Despite this the ester analogue of the dye was synthesised and the UV-Vis spectrum was recorded as well as the beer-lambert data plotted, with concentrations varying from  $0.5\mu\text{M}$ - $100\mu\text{M}$ . The molar extinction coefficient for the MLCT peak (indicated by red arrow) was calculated as  $22,621\text{mol}^{-1}\text{cm}^{-1}$ .

Overall this provided useful information to Dr. Cucinotta's research group and the project was considered a success. If I was to repeat the project I would try to be more efficient with time and be more careful when conducting laboratory experiments to ensure the synthesis was complete.



## References:

- <sup>1</sup> K. V. Rao, A. Jain, S. J. George, *J. Mater. Chem. C*, 2014, **2**, 3055-3064.
- <sup>2</sup> F. Hoffmann and M. Fröba, *Chem. Soc. Rev.*, 2011, **40**, 608-620.

