Research in the Zysman-Colman Group: Designing Photoactive Materials For Optoelectronics and Photocatalysis

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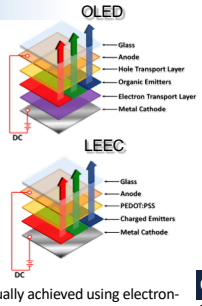
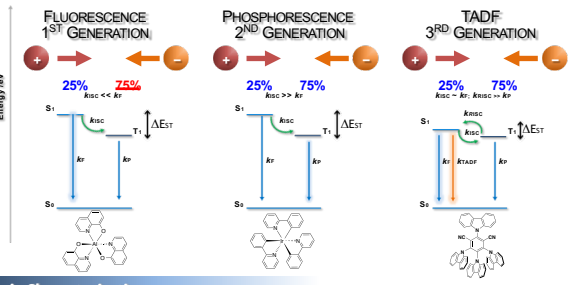
Organic Light Emitting Diodes & Light Emitting Electrochemical Cells

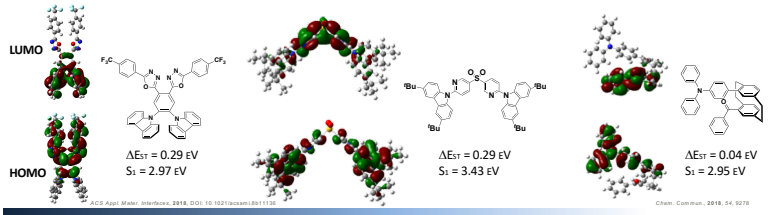
- OLEDs are a lighting and display technology based on a multi-layer device architecture that are emerging to dominate the mobile phone and display markets.
- LEECs are a second, younger, lighting technology based largely on a single layer solution-processable device architecture
- We focus on the design, computational modelling, synthesis, characterisation of organic thermally activated delayed fluorescence (TADF) and phosphorescent iridium(III) emitters, and fabrication of OLEDs and LEECs where we try and address the remaining grand challenges in materials design.





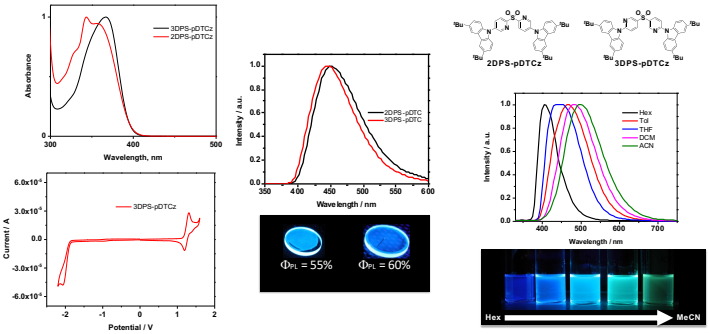
TADF Emitter Design

For TADF, a small ΔE_{ST} is required for efficient conversion of excitons from T_1 to S_1. This is usually achieved using electron-rich donors bonded to electron-deficient acceptors. This design results in a reduced exchange integral between HOMO and LUMO orbitals, which gives a small ΔE_{ST}.



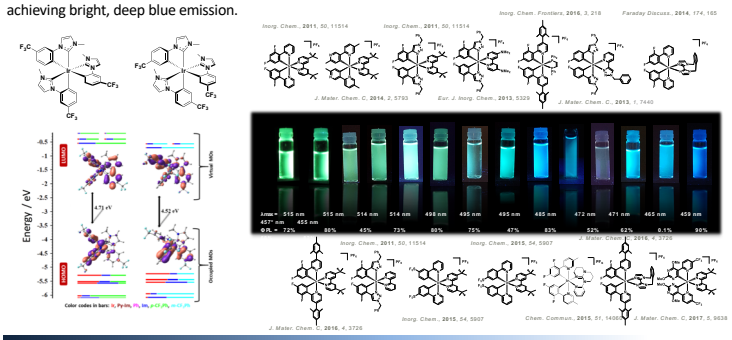
Optoelectronic Characterization

We perform a wide range of optoelectronic characterization techniques including: cyclic and differential pulsed voltammetry; absorption spectroscopy, steady-state and time-resolved photoluminescence spectroscopy; solvatochromic and variable temperature photoluminescence spectroscopy.



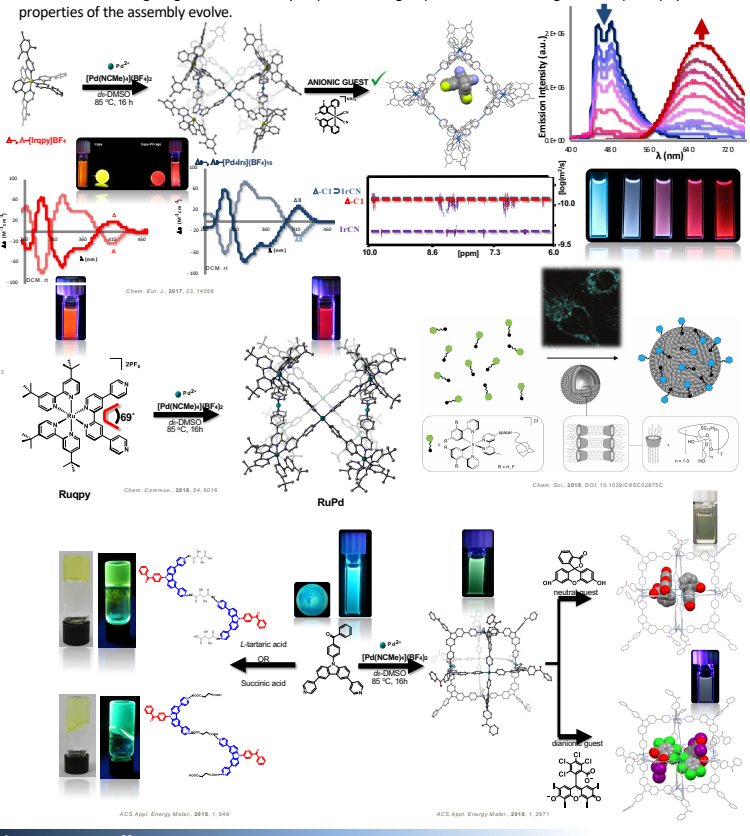
Iridium Complex Design

We develop both charged and neutral iridium(III) complexes for LEECs and OLEDs, respectively, mostly focussed on achieving bright, deep blue emission.



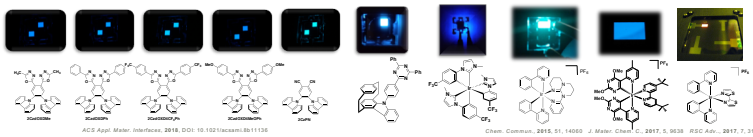
Self-assembly of Photoactive Units

Supramolecular chemistry offers synthetic tools to reliably order and self-organise units. We are particularly interested in investigating the self-assembly of photoactive groups and understanding how the photophysical properties of the assembly evolve.



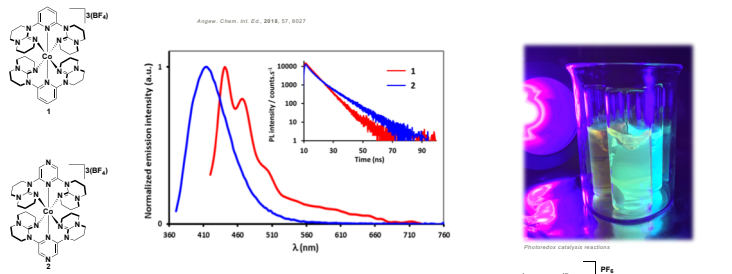
OLED and LEEC Devices

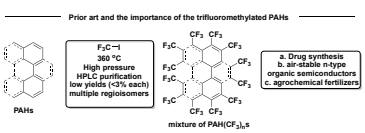
The most promising compounds are fabricated either into multilayer OLED devices by either solution-processing or vacuum deposition, or in LEEC devices by solution-processing.

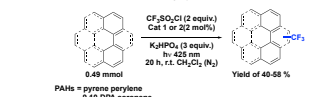


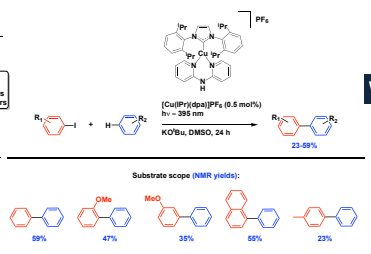
Photoredox Catalysis

Photoredox catalysis is the term used to describe photochemical reactions initiated and mediated with the aid of a photosensitizer. The most popular photocatalysts are based on ruthenium and iridium, for example $[Ru(bpy)_3]^{2+}$ and $[Ir(dF(CF_3)ppy)_2(dtbubpy)]PF_6$; however, these metals are toxic and not sustainable. We design photocatalysts from sustainable materials that, by virtue of their strong ground and excited state redox properties, can access chemistry that would be difficult to do using conventional (photo)chemistry.









What the EZ-C group offers

- ✓ The chance to work in a large, diverse and multidisciplinary group
- ✓ The opportunity to work in some of the most interesting, diverse and exciting areas of functional materials chemistry
- ✓ You will be taught many different skills from computational modelling, synthesis, electrochemistry and photophysics, all within a friendly and caring group
- ✓ Access to excellent facilities and equipment
- ✓ The chance to make beautiful glowing compounds.....need we say any more!

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