Design of multiresonance thermally activated delayed fluorescence materials for organic light-emitting diodes

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Open TASQ seminar

Wednesday October 30th, 2024, 14.00 a.m. CEST,
Library of Faculty of Chemistry
Zoom Meeting ID: 975 0639 0987, Access code: 932951
https://zoom.us/j/97506390987?pwd=Qo88XNjT8aZlUxlo7ZbhamIgCoTOhj.1

The first-generation OLEDs were based on organic fluorescent emitters. Their efficiency was intrinsically capped at 25% due to only being able to recruit singlet excitons. The second generation OLEDs have employed organometallic phosphorescent emitters, which harvest both singlet and triplet excitons for emission due to the enhanced intersystem crossing mediated by the heavy metals such as iridium(III) and platinum(II). These metal complexes possess very desirable optoelectronic properties and lead to very efficient OLED devices. However, the scarcity of these metals, their high cost and their toxicity are important detracting features. The third generation OLEDs are based on small organic compounds that emit via a thermally activated delayed fluorescence (TADF) mechanism. As with phosphorescent emitters, OLEDs using these emitters can recruit 100% of the excitons. In Donor-Acceptor TADF compounds, the emission is broad to the charge transfer character of the emissive singlet state. Multiresonant TADF emitters on the other hand show significantly narrower emission. In this presentation, I will discuss our recent efforts towards the design of multiresonant TADF emitters, particularly targeted for the blue, and demonstrate their performance in OLEDs.

Short Bio

Eli Zysman-Colman obtained his Ph.D. from McGill University in 2003 under the supervision of Prof. David N. Harpp as an FCAR scholar, conducting research in physical organic sulfur chemistry. He then completed two postdoctoral fellowships, one in supramolecular chemistry with Prof. Jay Siegel at the Organic Chemistry Institute, University of Zurich as an FQRNT fellow and the other in inorganic materials chemistry with Prof. Stefan Bernhard at Princeton University as a PCCM fellow. He joined the department of chemistry at the Université de Sherbrooke in Quebec, Canada as an assistant professor in 2007. In 2013, he moved to the University of St Andrews in St Andrews, UK, where he is presently Professor of Optoelectronic Materials, Fellow of the Royal Society of Chemistry and a past holder of a Royal Society Leverhulme Trust Senior Research Fellowship. His research program focuses on the rational design of: (I) luminophores for energy-efficient visual displays and flat panel lighting based on organic light emitting diode (OLED) and light-emitting electrochemical cell (LEEC) device architectures; (II) sensing materials employed in electrochemiluminescence; and (III) photocatalyst developing for use in organic reactions.