## **Coordination Chemistry for Light-Emitting Materials :** From the Visible to the Near-Infrared

## J. A. Gareth Williams

Department of Chemistry, Durham University, Durham, DH1 3LE, U.K. E-mail: j.a.g.williams@durham.ac.uk

Light-emitting iridium(III) complexes have been adopted all over the world for organic lightemitting diodes (OLEDs) used in mobile phones and other devices. The motivation for using 3<sup>rd</sup>row transition metals like iridium and platinum is that their high spin-orbit coupling constants facilitate emission from the triplet states that are normally wasted in a purely organic device.

In this presentation, the general factors to be considered in the design of highly emissive complexes will be reviewed, before considering the chemistry and excited-state properties of various complexes that contain tridentate cyclometallating ligands. Tridentate ligands can impart rigidity to metal complexes, helping to minimise non-radiative decay through molecular distortion. Meanwhile, cyclometallation leads to strong ligand fields, which are also crucial to favour luminescence.

Plenty of highly efficient green phosphorescent emitters have been discovered by now, but obtaining efficient blue and red emitters is more difficult. We will consider the challenges faced in moving to the deep red and near-infrared (NIR) regions of the spectrum. Dinuclear platinum(II) complexes  $\{i.e., \text{ containing two Pt}(II) \text{ ions}\}$  are emerging as interesting systems to target the NIR. Our recent work on two distinct classes of dinuclear complexes will be described:

- (1) planar rigid molecules featuring extended conjugation (*e.g.*, 1), where the molecular structure leads to particularly small singlet-triplet energy gaps  $\Delta E_{S-T}$ , and hence to the possibility of thermally activated delayed fluorescence (TADF);
- (2) "tweezer" molecules (*e.g.*, **2**), featuring two planar units connected such that they can engage in interfacial interactions to generate dimeric or excimeric excited states that emit at low energy.

Finally, new perspectives on the chemistry of the much less widely explored +4 oxidation state of platinum – in conjunction with tridentate and tetradentate ligands – will also be described. Though isoelectronic with Ir(III), the higher oxidation state of Pt(IV) presents its own challenges and leads to quite different reactivity and excited-state properties. Unusual dinuclear Pt(III) systems have also been discovered during the course this work (e.g. **3**).



## Selected recent references:

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