Understanding, Designing and Controlling the Electrochemiluminescence of Cyclometallated Iridium Complexes for Sensing applications

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Our research seeks to control electrochemiluminescence (ECL) processes in a number of ways: 1) By tuning the characteristic emission wavelength and redox potentials through systematic structural changes to the molecule during synthesis. 2) By making the colour of the ECL emission sensitive to the chemical environment of the molecule and 3) By making the colour of the ECL emission sensitive to the applied potential.

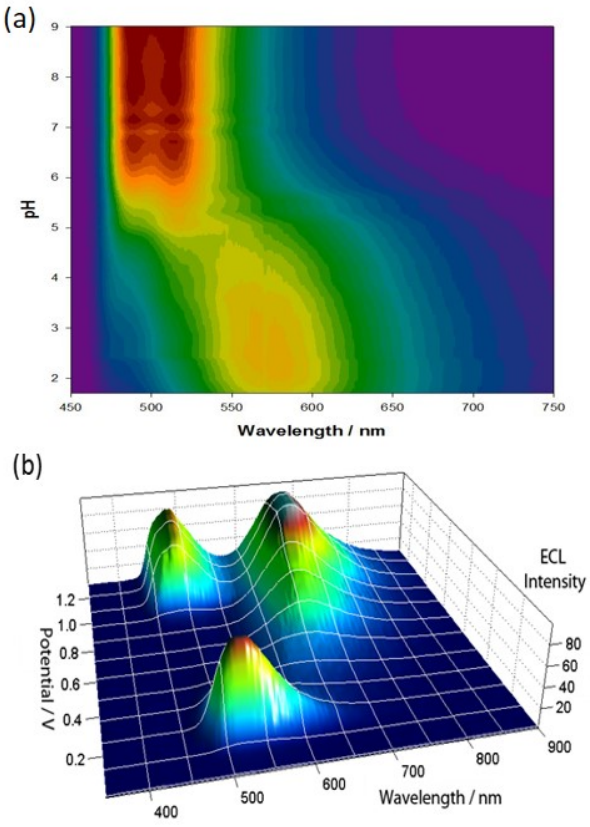

Figure 1 (a) Control of ECL emission colour of Iridium triazole complex using pH. (b) Control of ECL emission colour in mixed ECL systems using applied potential.

In this presentation it will be discussed how insight into the design of ECL emitters is gained by seeking to understanding the complex interplay of photophysical and electrochemical properties which dictate such characteristics. We have used this understanding to inform in the design of new electrochemiluminophores of varying oxidation potential and emission wavelength for potential sensing applications.[1-2]

The modulation of photoluminescent and ECL emission colour as a function of pH, where electrochemiluminescent complexes containing ligands which can be protonated, are shown to be pH sensitive with respect to their emission wavelength. The ability to control emission wavelength by selectively exciting luminescent species from mixtures or eliciting potential dependant changes to the luminophores will be discussed. Moreover, we will describe a new method to continuously vary the emission colour by scanning the electrode potential, producing 3D-ECL excitation emission matrixes. The prospects for enhanced selectivity or multiplexed ECL detection by exploiting both the potential and wavelength axes will be deminstrated. [3-5]

The application of the above concepts to low-cost sensing strategies based on paper microfluidics, where a mobile phone is co-opted to act as both a luminescence detector and a potentiostat will also be discussed.

References

[1] Gregory J. Barbante, E. H. D., Emily Kerr, Timothy U. Connell, Paul S. Donnelly, Jonathan M. White, Thais Lópes, Sarah Laird, David J. D. Wilson, Peter J. Barnard, **Conor F. Hogan** and Paul S. Francis, *Understanding Electrogenerated Chemiluminescence Efficiency in Blue-Shifted Iridium(III)-Complexes: An Experimental and Theoretical Study*. Chemistry - A European Journal **2014**.

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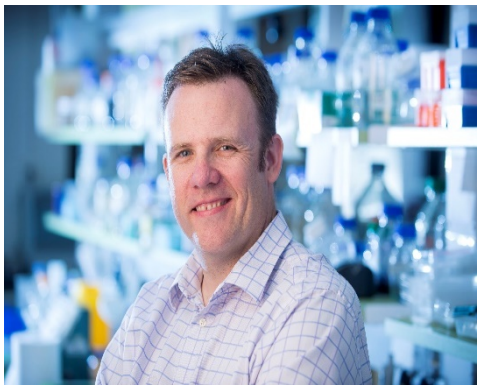
[3] Doeven, E. H.; Zammit, E. M.; Barbante, G. J.; Francis, P. S.; Barnett, N. W.; **Hogan, C. F.**, *A potential-controlled switch on/off mechanism for selective excitation in mixed electrochemiluminescent systems*. Chemical Science **2013,** 4 (3): 977-982.

[4] Doeven, E. H.; Zammit, E. M.; Barbante, G. J.; **Hogan, C. F.**; Barnett, N. W.; Francis, P. S., *Selective Excitation of Concomitant Electrochemiluminophores: Tuning Emission Color by Electrode Potential*. Angewandte Chemie-International Edition **2012,** 51 (18): 4354-4357.

[5] Egan H. Doeven, G. J. B., Emily Kerr, **Conor F. Hogan**, John A. Endler, Paul S. Francis, *Red-Green-Blue Electrogenerated Chemiluminescence Utilizing a Digital Camera as Detector*. Analytical Chemistry **2014** *86* (5) 2727.

Biography



Dr. Conor Hogan completed his PhD in Chemistry at Dublin City University in Ireland in 2000 and following several years of postdoctoral research in Ireland (under Prof. Robert Forster) and Australia (under Prof. Alan Bond) was appointed as a lecturer in the Department of Chemistry at La Trobe University, Melbourne Australia in 2003. Since 2016 he has been an Associate professor in analytical chemistry at the La Trobe Institute for Molecular Science where he leads one of the institute's five research themes (Molecular Sensing). Research in his group is varied and multidisciplinary. His fundamental research focuses on the interface between electrochemistry and photochemistry and is driven by applications in the field of chemical sensors and biosensors. He is known internationally for his contributions to the field of Electrochemiluminescence (ECL) and the development of mobile phone based sensing technologies. He is a Fellow of the Royal Society of Chemistry and the Royal Australian Chemical Institute. He is active in particular within the electrochemical and analytical divisions of the RACI. He was chair of the Electrochemical Division of the RACI from 2011 to 2013 and he is currently Australia & New Zealand regional representative for the International Society of Electrochemistry (ISE).

Website

http://www.latrobe.edu.au/chemistry-and-physics/research/chemistry-specialisations/electrochemistry-photochemistry-sensors

Publications

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