
Electrochemiluminescence from Kite-tailed Free Base and Zinc Porphyrins

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Abstract

Our research lab at The University of Western Ontario focuses on 4 research themes: scanning electrochemical microscopy of live cells and corrosion processes, ionic liquids as novel electrolytes, electrochemiluminescence or electrogenerated chemiluminescence (ECL) and solar cells. Herein, we demonstrate our progresses on electrochemiluminescence from kite-tailed free base and zinc porphyrins.

Porphyrins have rich biophysical and luminescent properties that make them of interest for electrogenerated chemiluminescence or electrochemiluminescence (ECL). However, vast numbers of porphyrin compounds do not translate to those of ECL investigations and applications—only a few reports on porphyrin ECL have been found.

Novel kite-tailed free base and zinc tetraphylporphyrins (TPP' and ZnTPP') were synthesized to increase their solubility in organic solvents and hopefully decrease the possibility dimer formation.

For the first time, we report highly efficient ECL of TPP' and ZnTPP' in the presence of tripropylamine (TPrA) as a reductive coreactant. Spooling ECL spectroscopy along with the ECL-voltage curve was used in analyzing the porphyrin ECL mechanisms. For instance, the strong ECL emission peak of 670 nm was attributed to the excimer and found to be monotonic with the applied potential during the light evolution and devolution for ZnTPP', while TPP' displayed monomer Q band emissions. The TPP' ECL reached a high efficiency relative to that of Ru(bpy)₃²⁺, which is the highest among the porphyrins. Insights have been obtained into grand avenues toward porphyrin ECL generation and applications.

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