Electrochemiluminescence application of boron-doped diamond electrodes

Andrea Fiorani
Department of Chemistry, Keio University, 3-14-1 Hiyoshi, Yokohama 223−8522, Japan
andrea.fiorani@keio.jp

Electrogenerated chemiluminescence, or electrochemiluminescence (ECL), is a luminescent phenomenon triggered by electrochemical reactions. Radicals produced at electrode undergo a high energetic electron transfer to generate the excited state, which later emits light.[1]
The combination of electrochemical and spectroscopic methods give ECL several advantages such as: temporal and spatial control on light emission, intrinsically very low background, then high sensitivity (pM), broad dynamic range (i.e. more than six order of magnitude) and rapid measurement (i.e. few seconds) in low volume (μl).
Applications of ECL mainly concern sensor and biosensor for a variety of analytes (e.g., metals ions, organic molecules, proteins, immunoglobulins, and DNA), as well as ECL imaging for the characterization of nanomaterials or cell mapping.[2]
Because ECL is primary triggered by an electrochemical reaction, the electrode material plays a major role in the signal generation, where the most common are Pt, Au, glassy carbon and carbon nanomaterials.[3]
We investigated the use of boron-doped diamond (BDD) electrodes for the ECL of the coreactants tri-n-propylamine (TPrA) and peroxydisulfate ($S_2O_8^{2-}$),[4] and a special method of coreactant generation directly in situ that can be achieved thanks to the particular characteristics of BDD. The oxidation of inorganic salts which later act as coreactants can be achieved by the wide potential window and the generation of hydroxyl radical from water oxidation.[6-7]
A peculiarity of BDD is the possibility to select the amount of boron doping level which affects the electrochemical behaviors, and this aspect has been investigated for the ECL emission.[8]
ECL at BDD is still in its infancy and needs proper investigation, furthermore the ECL by coreactant generation directly in situ might offer new opportunities for sensors development.

References

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