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Fundamentals to Applications

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Editorial

Electrochemiluminescence: Fundamentals to Applications

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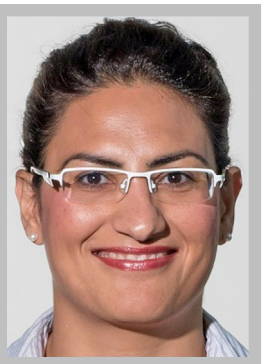
Electrochemiluminescence or electrogenerated chemiluminescence (ECL) is a phenomenon in which an excited state—formed by an electron-transfer reaction between electrogenerated species in the vicinity of a working electrode—emits light. Although the first detailed studies of ECL were reported in the 1960s, ECL publications have revealed an exponential growth worldwide thanks to advances in nanotechnology, photoelectrochemistry, and spectroscopy.[1,2]

Evidenced by the majority of the articles in this Special Issue, ECL has recently attracted much attention for developing bioassays in DNA sensing, enzymatic detection, and, most of all, immunoassays as very important tools in biomedicine, drug development, and hospital laboratories. This is attributed to the straightforward and easy measurement of ECL, which does not require a light source and is, thus, background-free, leading to a very high sensitivity as well as a broad measurement range. The vast use of this technique in clinical diagnostic immunoassays and DNA probe assays justifies the billion-dollar market demand each year. Besides clinical assays, ECL has found many applications in other fields of research, such as light-emitting devices, imaging technology, and scanning microscopy.

With such rapid growth in research using ECL, a dedicated Special Issue is timely. This *ChemElectroChem* Special Issue aims at giving a flavor of the ongoing research, ranging from theoretical and fundamental studies to the development of new materials as well as assays for various applications. The Reviews and Minireviews in this Special Issue outline the state-of-the-art research in various areas, highlighting current gaps and shortcomings, and offering new perspectives.

Looking at current developments, we may foresee that ECL is not only a commercial success in analytical applications, but also a diverse tool to answer fundamental questions in chemistry, biology, and physics. Owing to the remarkable features of ECL, the popularity of commercial ECL instrumentation, and the demand in various fields, a large increase is expected in the development of new assays and their applications in more clinical diagnostics, biodefense, drug screening, food and water safety, and environmental monitoring. We anticipate further advances in the miniaturization of ECL devices, high-throughput analytical assays, ECL imaging techniques, co-reactant systems, ECL light-emitting materials, and highly sensitive bioassays in the coming years.

[1] Z. Liu, W. Qi, G. Xu, *Chem. Soc. Rev.* **2015**, *44*, 3117 – 3142.
[2] M. Hesari, Z. Ding, *J. Electrochem. Soc.* **2016**, *163*, H3116 – H3131.



Dr. Liza Rassaei received her PhD in Chemistry in 2008 from the University of Eastern Finland with research on nanomaterials assembly into thin films. Afterwards, she explored the nanothermal effects of microwave radiation on electrochemical processes at the University of Bath (UK). In 2010, she joined the Nanoionics group at the University of Twente (Netherlands) and developed electrochemical bio-nanofluidic devices. In 2012, she moved to the BIOS Lab-on-a-Chip group in Twente and engaged in a project with industry on advanced diagnostic devices for non-invasive skin lactate sensing. Since 2013, she has been an Assistant Professor at Delft University of Technology (Netherlands). She has a multidisciplinary background and a broad interest in electrochemical systems. Recently, she was awarded Delft Global Fellowship with the aim to develop a tuberculosis diagnostic tool based on ECL.

Dr. Guobao Xu received BSc, MSc, and PhD from Jilin University (China), Xiamen University (China), and Changchun Institute of Applied Chemistry (China), respectively. After postdoctoral research at the University of Hong Kong (Hong Kong), Hong Kong Polytechnic University (Hong Kong), and NTT (Nippon Telegraph and Telephone Corporation) Microsystem Integration Laboratories (Japan), he joined Changchun Institute of Applied Chemistry in 2004. His research interests include ECL, point-of-care testing, electrochemical devices, as well as nanomaterial-based analysis and energy conversion.

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