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Editorial Overview: Surface electrochemistry for everyone

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Surface electrochemistry deals with the reactions and phenomena that take place at the electrode-electrolyte interface, which is a critical area in a broad range of applications, including electrochemical sensors, fuel cells, batteries, and corrosion protection. This thematic issue of Current Opinion in Electrochemistry collects selected short reviews by leading experts on key aspects and concepts of surface electrochemistry related to (i) electrocatalysis and its several applications such as fuel cells, (ii) corrosion and how to prevent the degradation of metals, (iii) electrodeposition and surface modification where the properties of the electrode surface are intentionally altered for achieving specific applications such as sensing particular (bio)analytes.

(i) Several relevant electrocatalytic reactions are addressed in the present issue. Electrocatalysis of oxygen reduction reaction on platinum electrodes for fuel cells and water electrolyzers is covered by **Chatenet's group** in the review "*3D-structured electrocatalysts for improved mass-transfer in proton-exchange membrane fuel cell cathodes*" presenting organized catalyst layers on 3D-structured electrodes for more efficiently utilize platinum in fuel cells, as well as by **Tryk** and **Kuzume** in their review "*The electrochemistry of platinum-group and noble metals as it relates to fuel cells and water electrolysis: Vibrational spectroscopic and computational insights*" presenting the state-of-the-art in vibrational spectroscopy (infrared and Raman) characterization under operating conditions combined with computational density functional theory (DFT) calculations. In contrast, electrocatalysis of the electrochemical reduction of CO₂ is addressed from a materials science point of view by **Ania's group** in the review "*Nanoporous carbons for the electrochemical reduction of CO₂: Challenges to discriminate the roles of nanopore confinement and functionalization*" presenting the impact of nanopore confinement and surface functionalization on carbon-based electrocatalyst performance, as well as the question of industrial viability of electrochemical CO₂ conversion is discussed by **Schreiber** in his review "*Industrial CO₂ electroreduction to ethylene: Main technical challenges*" identifying the electrolyzer cell potential as the limiting factor in technological development at large scale and proposing strategies to lower it. Furthermore, electrocatalysis of hydrogen evolution reaction catalyzed by supported and unsupported molecular macrocyclic complexes is covered by **Zagal's group** in the review "*An overview of the catalytic activity of MN₄ molecular catalysts for the heterogeneous hydrogen evolution reaction*" presenting a mechanistic insight and evaluating the structure of the catalyst and the nature of the support, as well as hydrogen oxidation/evolution reactions in high temperature fuel cells and electrolyzers are covered by **Ringuedé's group** in the review "*Prospects of hydrogen and its derivative as energy vector for electricity production at high temperature: Fuel cells and electrolyzers*" presenting solid oxide cells, molten salt cells and their combination in a hybrid cell.

(ii) Corrosion control aspects are covered by **Novoa** and **Pérez** in their review *“The use of smart coatings for metal corrosion control”* presenting some relevant developments in the characterization of corrosion phenomena in the presence of two commonly employed coating types (organic and inorganic based ones) and the current strategies to improve the performance of these coatings, which consist of giving them self-healing characteristics for extending their service life.

(iii) Different electrodeposition and electrode surface modification aspects are addressed and covered by **Ghilane’s group** in his review *“When ionic liquids meet diazonium salts to generate thin layers modified surfaces”* highlighting the growing attention given to the encounter between the ionic liquids and diazonium compounds for building organized interfaces through different grafting procedures. A particular emphasis is placed on covalent grafting of diazonium moieties without external electrical bias and the added value of ionic liquids as a grafting medium. Moreover, **Fantin** and **Isse** in their review *“Improvement of electrode performance by grafting polymers via atom transfer radical polymerization (ATRP)”* discussing the use of ATRP to modify electrode surfaces with polymers and create functional materials for electrochemical applications. Particular attention is devoted to the electrochemically mediated atom transfer radical polymerization (eATRP), which allows controlling the polymerization process by tuning the applied potential or current. Those authors point out the ATRP benefits for the fabrication of supercapacitors, electrocatalysts, and ultrasensitive electrochemical sensors. Finally, **Miranda-Castro** and co-workers in their review *“Enzyme-assisted isothermal amplification of nucleic acids on the electrode surface”* chronicling the evolution of enzyme-assisted isothermal nucleic acid amplification strategies (helicase-dependent amplification (HDA), loop-mediated isothermal amplification (LAMP), and recombinase polymerase amplification (RPA)), directly coupled to conductive platforms to facilitate the electrochemical transduction, and describing the current state of the art, and the identification of some of the challenges to bring these new platforms to the real practice as point-of-need tests.

We would like to thank all authors for their interest in participating and their relevant contributions. This group of short reviews represent a nice selection of topics within the major field of Surface Electrochemistry and we are certain that will be of great interest for a broad range of readers.