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Editorial

Immobilized Non-Precious Electrocatalysts for Advanced Energy Devices

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The expected near depletion of fossil fuels encourages both the research and industrial communities to focus their efforts to find effective and sustainable alternatives. Electrochemical devices, including fuel cells, batteries, supercapacitors, solar cells, etc., have been found to be the optimal life raft away from this dilemma. Aside from the potential for power generation from untraditional energy sources such as wastewater, electrochemical devices are highly recommended from an environmental point of view. The zero-emission of the exhaust gases greatly helps to solve one of the most dangerous problems currently facing the planet: the increasing climate temperature. Therefore, it would not be an exaggeration to claim that the development of electrochemical devices is considered an existential demand.

In the first era of these promised devices, precious metals such as platinum, palladium, and ruthenium were the main constituents in the manufacture of both cathodes and anodes. However, their high cost constrains the commercial application of these devices [1]. Compared to anodes, precious metal-based compounds as cathode materials were widely exploited. However, the thermodynamic potential of ORR (1.23 V vs. NHE at standard conditions) is so high that the Pt electrode cannot remain pure. Accordingly, the performance decreases due to the formation of PtO [2,3]. Consequently, non-precious metals must be used as electrodes in electrochemical devices not only for cost-decreasing reasons but also for the long-term use of these devices. In this regard, numerous non-precious electrodes have been introduced for different electrochemical devices including fuel cells [4–6], supercapacitors [7], batteries [8], and others [9–12].

Since most of the electrochemical reactions can be considered a combination of adsorption and chemical reaction, carbonaceous materials are widely invoked as supports for different functional materials. Specifically, carbon nanostructures including graphene, carbon nanotubes, and carbon nanofibers show a distinguished enhancement in electrocatalytic activity. Their large surface area and well-known high adsorption capacity improves both mass transfer and reaction(s) kinetics operations. Therefore, different techniques have been proposed for the immobilization of the functional materials on proper supports.

In this regard, this Special Issue entitled "Immobilized Non-Precious Electrocatalysts for Advanced Energy Devices" aims to collect innovative and high-quality research. Along with being a highly informative review article in the field of green hydrogen production, this issue contains nine articles introducing different functional non-precious materials immobilized on various supports. Moreover, the guest editor did his best to focus on popularly discussed topics to draw the maximum amount of attention from the researchers working in the advanced energy devices field. Consequently, a variety of interesting topics are covered in this issue including urea electrooxidation, dye sensitized solar cells, oxygen reduction reactions, and methanol & ethanol electrooxidation.

In summary, the current Special Issue covers cutting-edge techniques for addressing open problems about the use of non-precious metals in the most appealing energy devices and the immobilization of these functional materials on appropriate supports. Finally, the guest editor wishes to thank the editorial staff for their professional help as well as all the contributed authors for their outstanding scholarly contributions.

Conflicts of Interest: The author declares no conflict of interest.

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