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Editorial

ACS Sustainable Chemistry & Engineering Virtual Special Issue on Sustainable Electrochemical Energy Technologies (Héctor D. Abruña Festschrift)

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This Festschrift virtual special issue is to honor Dr. Héctor D. Abruña on the occasion of his 70th birthday. Dr. Abruña is currently the Émile M. Chamot Professor in the Department of Chemistry and Chemical Biology at Cornell University. He was born and raised in Puerto Rico and pursued his higher education in the continental US, receiving his B.S. (1975) and M.S. (1976) degrees in chemistry from Rensselaer Polytechnic Institute, followed by a Ph.D. degree in chemistry (1980) from the University of North Carolina at Chapel Hill with Royce W. Murray and Thomas J. Meyer. After a postdoctoral appointment at the University of Texas at Austin with Allen J. Bard, he started his independent career at the University of Puerto Rico in 1982 and moved to Cornell University in 1983, where he has remained ever since. Dr. Abruña has had a truly distinguished career over the past four decades, making seminal contributions in a wide range of research areas that span from chemically modified electrodes, surface science, and electroanalysis in the early days of his career to nanoelectronics and electrochemical energy technologies more recently. He has so far published over 560 peer-reviewed research articles and collected a number of prestigious awards and honors, including the election to the American Academy of Arts and Sciences in 2007 and the National Academy of Sciences in 2018. In addition, he has graduated over 60 Ph.D. students and hosted as many postdoctoral and visiting scholars, who are hailed from many different corners of the globe.

As part of the festivity, in this virtual special issue (https://pubs.acs.org/page/ascecg/vi/hector-abruna-electrochemistry), we highlight the latest breakthroughs on the various forefronts of electrochemistry by former students, friends, and colleagues, within the thematic context of sustainable electrochemical energy technologies. This collection covers a wide range of research topics, focusing primarily on energy conversion and storage, with an article by Velický. Also among these, the development of solar cells and solar fuel production represents an effective strategy, where the rational design and engineering of the electrode materials entail a critical first step. Zhou et al. employ a combinatorial approach to survey ternary antimonate (X−Sb−O, X=Mg, Al, Cr, Fe, Co, Ni, Cu, Zn, Y, Ag, In, La, Pb, and Bi) materials as photoanodes for solar-driven oxygen production from water, from which 19 photoanode phases are identified as viable options. To enhance the stability and durable operation of solar cells, Zhong and coworkers argue that the incorporation of electropolymerized films onto the electrodes may be an effective solution. In another study, Lopato et al. describe a photocatalytic process whereby biorenewable alcohols are exploited as the electron/proton source for the photogeneration of hydrogen with a molecular iridium photosensitizer. Powered by green electricity, electrochemical water splitting (water electrolyzer) can become an important sustainable technology. Wang et al. demonstrate that porous carbon-supported ruthenium nanoparticles can serve as high-performance catalysts for the electrochemical production of hydrogen. Lei and coworkers show that the durability of anion exchange membrane water electrolysis can be impacted by the analytes due to the structural transformation of the oxygen evolution reaction (OER) catalysts.

Another significant portion of the collection is devoted to fuel cell electrochemistry, which consists of two half-reactions, fuel oxidation at the anode and oxygen reduction reaction (ORR) at the cathode. Again, the optimization of catalyst performance is the most critical step. Mallouk and coworkers employ a parallel fluorescent screening method to evaluate a library of 1584 catalyst samples, and Pt_6Sn_4 is identified as one of the most active samples toward the hydrogen oxidation reaction (HOR). Rizo et al. employ well-defined platinum surfaces as the model and examine the mechanism of the selective electro-oxidation of ethanol on platinum in aqueous media. Novak et al. demonstrate that Cu nanoparticles supported on CeO_2 or Gd(III)-substituted CeO_2 (GCO) aerogels deliver a rare combination of high activity, selectivity, and stability for the preferential oxidation of carbon monoxide (COPROX). Significant progress is also made in the development of ORR electrocatalysts. Martınez-Fernández et al. report a facile strategy to manipulate the ORR activity of metal-free and nonpyrolyzed materials by postsynthetic modification of covalent organic frameworks (COFs) via click-chemistry. Qin et al. observe a high electrocatalytic activity of ternary platinum-based ordered intermetallic nanoparticles encapsulated within a nitrogen-doped carbon shell toward the four-electron reduction of oxygen to water. Zhao et al. electrochemically screen Au_xPt_y nanocatalysts for

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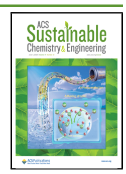

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the selective production of hydrogen peroxide from two-electron ORR and hydrogen oxidation. Yu et al. show that copper/carbon nanocomposites can be used for the selective production of hydrogen peroxide from two-electron ORR due to the electrochemical enrichment of Cu_2O species, which can be exploited for the electrodisinfection of water. Yang and co-workers employed *operando* electrochemical liquid-cell scanning transmission electron microscopy to study the structural dynamics of Cu nanocatalysts in CO_2 electroreduction.

Lastly, significant strides have also been made in battery research. Lee et al. review the metal deposition mechanism of multivalent metal anodes of Mg, Ca, and Al, and present strategies to inhibit their dendritic growth. Hu et al. summarize the latest progress in solid-state lithium batteries. Li and coworkers report the preparation of V_2O_5 nanoribbons on reduced graphene oxide nanosheets as cathode materials for high-capacity and stable aqueous zinc-ion battery.

In these studies, unique structural insights can be obtained with a range of state-of-the-art spectroscopic and electrochemical techniques, such as scanning electrochemical microscopy (SECM) (Tao et al.), Raman spectroscopy (Yu et al.), and time-resolved spectroscopy (Xu and Suntivich), in conjunction with first-principles calculations (Ozuguzel et al.).

As guest editors, we would like to express our sincere gratitude to these wonderful colleagues who took the time to make these valuable contributions. We hope that the readers will also find these papers interesting and enjoy the reading.

Finally, Feliz Cumpleaños, Tito!

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