ACS Sustainable Chemistry & Engineering

Editorial

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Novel Catalytic Materials for Energy and the Environment

Catalysis has long been recognized as a pillar of green and sustainable chemistry.[1,2] It opens the possibility to provide less polluting processes both in terms of net waste and energy usage. Photo- and electrocatalysis further expand this capability to rationalize energy use in transformations. Catalysis also makes new synthesis pathways possible using novel starting materials, in particular biomass-based ones, to afford currently needed products. Catalysis is fueling some of the most exciting discoveries in the fields of energy and the environment.

At the Materials Research Society (MRS) 2017 Spring meeting in Phoenix, Arizona, leading researchers in the field of catalysis were invited by Yu Han (King Abdullah University of Science and Technology), Phillip Christopher (University of California-Riverside), Zili Wu (Oak Ridge National Laboratory), and Ning Yan (National University of Singapore) to present their recent work in a symposium entitled "NM4: Novel Catalytic Materials for Energy and Environment". Invited and selected speakers in this symposium were encouraged to contribute to this Virtual Special Issue (VSI) in *ACS Sustainable Chemistry & Engineering*, in an effort to capture the current state of research in the field. The resulting "Novel Catalytic Materials for Energy and the Environment" VSI collection covers a broad range of topics from electro- and photoelectrocatalysis for water splitting to biomass conversion and organic methods (http://pubs.acs.org/page/ascecg/vi/catalytic-materials.html).

Recently, intense research efforts on artificial photosynthesis have led to rapid progress in electro- and photoelectrocatalytic water splitting and its two component reactions, hydrogen evolution reaction (HER) and oxygen evolution reaction (OER).[3,4] In this VSI, we highlight works toward more efficient water splitting via the use of a chromium layer on Pt catalysts to prevent negative side reactions (http://dx.doi.org/10.1021/acssuschemeng.7b01704) and better OER with porous lanthanum cobaltite (http://dx.doi.org/10.1021/acssuschemeng.7b02815). CO_2 reduction, for its capture and subsequent conversion to useful molecules, is another exciting avenue for sustainability, and recent years have seen progress using carbon-based materials.[5] Here, we showcase a theoretical study of the role of defects in graphene (http://dx.doi.org/10.1021/acssuschemeng.7b03031), and the use of oxygen-exposed silver nanoparticles (http://dx.doi.org/10.1021/acssuschemeng.7b02380) toward the electrochemical reduction of CO_2. The interaction of CO_2 with the catalytic surface is of major importance, and it was specifically studied in the case of titania (http://dx.doi.org/10.1021/acssuschemeng.7b02295). The catalytic oxidation of CO is another important process to mitigate pollution by this toxic gas.[6] "Inverse catalysts", where oxide nanoparticles are deposited onto noble metal ones, demonstrate improved activity for this reaction (http://dx.doi.org/10.1021/acssuschemeng.7b02744). On the other hand, biomass conversion is an established field of sustainable catalysis.[7,8] Here, N-heterocyclic compounds are generated in one step from carbohydrates using tungsten-based catalysts (http://dx.doi.org/10.1021/acssuschemeng.7b03048). Gold nanoparticles over ceria are used as catalysts to access acrylic acid directly from glycerol, in two steps (http://dx.doi.org/10.1021/acssuschemeng.7b02457). Finally, a silicon waste material is used as the hydrogen source in a metal-free transfer hydrogenation reaction (http://dx.doi.org/10.1021/acssuschemeng.7b03298).

We are thankful to all of the contributors to this VSI, in particular, all authors of these articles, participating reviewers, and editors, especially Professors David T. Allen, Bert Sels, Bala Subramaniam, Dr. Rhea Williams, and the editorial team at *ACS Sustainable Chemistry & Engineering*. We also acknowledge Yu Han, Phillip Christopher, and Zili Wu for organizing the MRS symposium at the origin of this initiative. We hope this VSI will serve as a highlight of research in sustainable catalysis for energy and the environment and encourage more submissions in this important area to the journal.

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Received: November 13, 2017
Published: December 4, 2017

DOI: 10.1021/acssuschemeng.7b04217
ACS Sustainable Chem. Eng. 2017, 5, 11124−11124