

RESEARCH ARTICLE | SEPTEMBER 28 2015

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APL Mater. 3, 103801 (2015)

<https://doi.org/10.1063/1.4931652>



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Preface for Special Topic: Photocatalysis

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(Received 8 September 2015; accepted 12 September 2015; published online 28 September 2015)

[<http://dx.doi.org/10.1063/1.4931652>]

Photocatalysis provides an environmentally friendly approach to convert solar energy into chemical energy based on a series of photophysical processes and photochemical reactions. The potential applications of photocatalysis mainly involve water photolysis to produce molecular hydrogen as energy carrier, photodegradation or photodecomposition of harmful substances, CO₂ photoreduction to yield organic fuels, and photoelectrochemical conversion. Developing new and advanced photocatalysts has been one of most effective approaches to enhance the photocatalytic efficiency which is indispensable for realizing practical applications of this technique. Thereby, the new photocatalysts have been developed into a huge material system including inorganic compounds, polymers, metal complexes, metal-organic frameworks, and metals (e.g., plasmonic metal coupling).

Thanks to the emergence of the new photocatalysts, the photocatalytic efficiency has improved year on year over the past decades. However, the in-depth understanding of the physical and chemical mechanisms behind the newly developed materials still needs further investigations, especially those of the composite photocatalysts containing different kinds of materials. Thus, both *in situ* characterizations and theoretical simulations will attract more extensive attention in the future. As to the synthesis, besides the development of new and advanced photocatalysts, the surface/interface modulation to enhance the separation and utilization of photocarriers has been shown to be one of the most attractive approaches and will be expanded towards the operation at atomic and molecular scales.

This special issue invited researchers from different backgrounds to exhibit their perspective of the trends in the development of advanced photocatalytic materials as well as its related characterizations and theoretical studies. It also attracted a number of contributed papers. We hope that these studies will generate further wide attention and interest in the area of photocatalysis which is an interdisciplinary research field focusing on materials science and also involving physics, chemistry, energy science, and environment science. Hence, we look forward to your future submissions to APL Materials, especially concerning studies in photocatalysis.

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