

CBC Virtual Seminar Series



Dr Leow Wan Ru

University of Toronto, Canada

Powering Selective Oxidations of Organic Molecules with Renewable Energy

The partial oxidation of organic molecules is an important class of reactions for the production of everyday commodities. An example is the polyethylene terephthalate (PET) plastic found in our drinking bottles – the precursors oxirane and terephthalic acid are produced from the partial oxidation of ethylene and xylene at 20 and 60 million tons per annum. Every year, 1.8 billion tons of CO₂ are emitted due to the dependence of such partial oxidations on fossil-fuel-powered thermal control, as well as the tendency of these hydrocarbons tend to oxidize all the way to CO₂.¹ If we can develop high selectivity partial oxidations that are powered by renewable energy, we will be able to cut these associated CO₂ emissions by half.²

In this talk, I will first discuss the activation of different functional groups on heterogeneous surfaces, to enable photocatalytic electron transfer under ambient and benign conditions.³⁻⁴ Key insights for rational surface engineering of heterogeneous photocatalytic materials to achieve partial oxidations for pharmaceuticals and fine chemicals will also be described. The second part will be focused on electrochemical partial oxidation at breakthrough current densities (1 A/cm²) by extending the reaction interface from the electrode surface with a charge mediator.⁵ These studies open opportunities for the development of alternative chemicals manufacturing routes towards a sustainable and decarbonized economy.

References

1. Boulamanti, A., Moya, J. A. Energy efficiency and GHG emissions: Prospective scenarios for the Chemical and Petrochemical Industry. 2017.
2. Zheng, J., Suh, S. Strategies to reduce the global carbon footprint of plastics. Nat. Clim. Change. 2019, 9 (5), 374-378.
3. Leow, W. R., Chen, X. et. al. Al₂O₃ surface complexation for photocatalytic organic transformations. J. Am. Chem. Soc. 2017, 139 (1), 269-276.
4. Leow, W. R., Chen, X. et. al. Correlating the surface basicity of metal oxides with photocatalytic hydroxylation of boronic acids to alcohols. Angew. Chem. Int. Ed. 2018, 57 (31), 9780-9784.
5. Leow, W. R., Lum, Y., Sargent, E. H. et. al. Selective ethylene oxide electrosynthesis at high current density enabled by a chloride mediator. Science, Accepted 2020.

Biography

Wan Ru Leow is currently a postdoctoral fellow in the Edward S. Rogers Sr. Department of Electrical and Computer Engineering, University of Toronto. She received her B.Eng. degree in 2012 from the School of Chemical and Biomedical engineering and her Ph.D. in 2017 from the School of Materials Science and Engineering in Nanyang Technological University. Her research interests are focused on the study and design of photocatalytic and electrocatalytic systems for decarbonized chemical conversions.

Date: 3rd June 2020, Wednesday
Time: 11.00 am to 12.30 pm
Venue: Zoom Platform
Host: Dr Lee Hiang Kwee

For Zoom registration:

