ICFO



INSIGHT SEMINAR: Towards the electrification of chemical production

IFAN E.L. STEPHENS

April 18, 2024
12:00 to 13:00
Seminar Room

BIO

Ifan conducted his PhD at the University of Cambridge. In 2008, Ifan moved to the Department of Physics at the Technical University of Denmark (DTU) and stayed there until 2017, where he was ultimately employed as Associate Professor.

Ifan moved to the Department of Materials at Imperial College London in 2017; he currently holds the position of Professor of Electrochemistry there. His group's research aims to enable the large-scale electrochemical conversion of renewable energy to fuels and valuable chemicals and vice versa. Such processes will be critical in order to allow the increase uptake of renewable energy.

? Ifan has published >90 papers on topics including oxygen reduction, oxygen evolution, CO_2 reduction and nitrogen reduction. Ifan's research on H_2O_2 electrosynthesis led to the

establishment of the spinout HPNow, which he co-founded. Stephens is the recipient of numerous awards, including the Peabody Visiting Associate Professorship from MIT (2015), the RSC's John Jeyes Award (2021), an ERC Consolidator Grant (2021-2025) and Clarivate Highly Cited Researcher (2022-2023).

ABSTRACT:

Our most commonly produced chemicals, such as ethylene or ammonia are currently produced in large-scale centralised plants, typically at elevated temperatures and pressures. The transport of these reactive compounds to the end user poses significant safety and logistical challenges. However, with the advent of inexpensive renewable electricity, electrochemical routes of synthesising these chemicals are becoming increasingly attractive. Low temperature electrochemical devices are particularly amenable towards coupling with renewables. They require little infrastructure; as such, they could allow for localised chemical production at the point-of-consumption.

In this contribution, I will discuss recent developments in water electrolysis, nitrogen reduction to ammonia and biomass valorisation. I will focus on the catalyst material at the electrodes, i.e. the electrocatalyst. Combining electrochemical experiments with advanced operando and ex situ characterisation, and augmented by DFT calculations, I will reveal the underpinning bottlenecks in each of the reactions under study and suggest avenues for engendering future improvements.

Hosted by: Prof. Dr. F. Pelayo Garcia de Arquer