Electroactive materials as a platform for the transformation of CO_2

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Abstract:

The inclusion of electroactivity into functional inorganic materials (such as Metal-Organic Frameworks (MOFs) or Porous-Organic Polymers (POPs)) is driven by the need to better understand the mechanism of charge transfer in the solid state. The design of MOFs and POPs with intrinsic charge transfer properties permits their potential application as energy storage devices, conductive materials, electrochemical sensors and electrocatalysts.[1,2] MOFs and POPs possess the additional advantages of being robust, straightforward to synthesise and highly tunable. The incorporation of both bare metal sites and redox-active ligands into these materials provides one such strategy to unlock materials capable of the photochemical and electrochemical transformation of CO_2.

The judicious choice of metal centre is necessary to achieve electroactivity in MOFs and POPs. The [M(**bpy**)(**CO**)$_3$X] (M =Mn, Re, Ru **bpy** = 2,2'-bipyridine, X = halogen) complexes are well-known to be good homogeneous photo and electrocatalysts.[3] Likewise, the "privileged" salen metal complex has found applications as a chemisensor, discrete electrocatalyst and a key reagent in the chemical conversion of CO_2.[4] The chemistry of these complexes is underpinned by a rich redox chemistry encompassing unique charge transfer properties.

This presentation describes methods for the heterogenisation of redox-active metal complexes into MOFs and POPs for the photochemical and electrochemical transformation of CO_2. Some of these strategies will be critically evaluated in order to address the challenges that are facing chemists in the pursuit of solid state photo- and electrocatalysts.

References

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Biographical Statement of speaker:

Marcello Solomon obtained his B Sc. (Adv. Maths) at The University of Sydney in 2012. He has recently completed his Ph.D. under the supervision of A/Prof. Deanna D'Alessandro and Prof. Katrina Jolliffe, in which he studied the synthesis and electrochemical properties of salen metal complexes and their MOFs.