**Harnessing Solar Energy through Nano-Catalysts for Power to X**

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Catalysis is the heart of chemistry – most chemical reactions need catalysts – so we want to make these reactions efficient and the process as sustainable as possible. Turning to solar as an energy source to activate nano-catalysts is an obvious place to focus our investigations because it reduces our reliance on unsustainable fossil fuels. There are a number of means in utilising the sun’s energy to drive energetically demanding catalytic processes. We can use (i) electricity from photovoltaic transformation of sunlight to drive electro-catalytic reactions, (ii) heat of the sun to activate thermal catalyst, and (iii) light of the sun to excite electrons from valence band of a semiconductor to its conduction band.

Here, we present our ongoing research in harnessing the full solar energy spectrum (from ultraviolet to infra-red) using nano-catalysts to induce or/and enhance catalytic CO2 reduction. Using solar energy to catalytically reduce CO2 has the potential to convert the waste CO2 into fuel and feedstocks, allowing the dual opportunity to store the intermittent renewable energy as well as closing the anthropogenic carbon cycle.



Fig. 1 Harnessing Solar Energy through electrocatalysis and photo-thermal catalysis to convert CO2 and H2O to Fuel and Chemical Feedstock.