

Past and Present Research Systems of Green Chemistry

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Green fuel. Selective and water compatible catalysts for solar fuel production

Craig L Hill
Emory University, USA

In order to meet global requirements for environmental preservation and adequate energy for society, it will be necessary to develop green, sustainable sources of energy on a massive scale. Unfortunately the renewable energy sources don't have the capacity to power the planet, with the exception of solar (terrestrial sunlight). Sadly, nuclear fusion still faces monumental challenges. In addition, we must have fuel energy, not just electrical energy because most major energy needs (air travel, shipping, etc.) require high-density energy. This explains the enormous international effort to realize solar fuel (do artificial photosynthesis). The 2 principal reactions in solar fuel production are splitting of water and reduction of CO₂ by H₂O to generate H₂ and carbon-neutral fuel, respectively. The Hill group efforts have shifted in recent years from green catalytic selective oxidations of organic substrates to selective catalytic oxidative removal of toxic molecules in human and natural environments, and the extremely active research area of catalytic water oxidation, which is essential for making solar fuel. Many of the key requirements for successful, green oxidations of organic substrates and water are the same: catalysts that are highly selective, stable and fast and that proceed by known and controllable mechanisms to minimize waste and facilitate green operation. We will address these points and end with describing polyoxometalate (POM)-based water oxidation catalysts (WOCs) that are among the most effective, if not the most effective, homogeneous WOCs known at present.

Biography

Craig L Hill is trained at MIT (PhD; Whitesides) and Stanford (NSF PD; Holm) and is the Goodrich C White Professor of Chemistry at Emory University. He studies catalysis (green oxidations; multielectron processes, decontamination, others), mechanisms and materials. He has trained ~130 graduate students and postdocs. Google Scholar lists ~340 journal publications that are cited 20,065 times (H index = 72). Three of these already exceed 1000 citations. He has been the recipient of three ACS awards, many others and is a member of two academies.

lchauvi@emory.edu