ICCDU XVI
27-30 August, 2018
Rio de Janeiro, Brazil

16th INTERNATIONAL CONFERENCE ON CARBON DIOXIDE UTILIZATION

Novel $W_{18}O_{49}$–TiO_2 Materials for Solar Fuel Production from CO_2 Photoreduction

Jeannie Z. Y. Tan, Meltiani Belekoukia, Jin Xuan, M. Mercedes Maroto–Valer.
Research Center of Carbon Solutions (RCCS), School of Engineering & Physical Sciences, Heriot-Watt University, Edinburgh, United Kingdom.
**Corresponding author: j.tan@hw.ac.uk*

Keywords: TiO_2, nano-peas, photoreduction, sea urchins

Artificial photosynthesis has attracted wide interest in mitigating the atmospheric greenhouse gas, CO_2, as well as in generating solar fuels. However, materials with oxygen–vacancy–rich have not been much explored for CO_2 photoreduction, despite their intrinsic advantages, including change of gas adsorption capability, optical properties and electronic structures.[1]

Oxygen–vacancy–rich $W_{18}O_{49}$ was previously used for the photochemical reduction of CO_2 and showed 95% selectivity towards CH_4 under visible light irradiation in the absence of co–catalyst. Moreover, core–shell compounds have been shown to improve the light absorption, generation and separation of electron–hole pairs for various photocatalytic processes.[2] Therefore, the aim of this work is to develop $W_{18}O_{49}$ anchored on the surface of TiO_2 nano–peas in order to optimize selectivity towards different hydrocarbons, such as CO, HCOOH, etc.

The synthetized TiO_2 nano–peas were highly crystallized, with anatase phase as shown in the XRD pattern. When the $W_{18}O_{49}$ was incorporated onto TiO_2 nano–peas, sea urchin–like nanoparticles were obtained. The composite TiO_2–$W_{19}O_{48}$ materials were characterised using Raman, XPS, FTIR and UV–vis. The CO_2 photoreduction efficiency and product selectivity were significantly affected by the surface coverage of $W_{18}O_{49}$ on the TiO_2 nano–peas. In conclusion, the proposed core–shell semiconductor composites have offered an alternative to tailor photocatalysts as well as to avoid the use of the previous metal co–catalyst, such as Pt.

Acknowledgments

The authors thank the financial support provided by the Engineering and Physical Sciences Research Council (EP/K021796/1) and the Research Centre for Carbon Solutions (RCCS) at Heriot–Watt University.

References

[1] X. Chen, L. Liu, P. Y. Yu, S. S. Mao, *Science* **2011**, 331, 746-750; bX. Chen, L. Liu, F. Huang, *Chem. Soc. Rev.* **2015**, 44, 1861-1885.
[2] X. Zheng, L. Zhang, *Energy Environ. Sci.* **2016**, 9, 2511-2532.