Novel photocatalytic systems for production of solar fuels

Chieh-Chao Yang[1], and Guido Mul[1]

[1] PhotoCatalytic Synthesis group, Faculty of Science and Technology, University of Twente, P.O. Box 217, 7500 AE Enschede

Various studies [1] have shown that (metal promoted) titania-based catalysts allow production of single-carbon molecules in photocatalytic CO_2 reduction, such as CH_4 and CH_3OH. In this presentation an overview of the current fundamental understanding of the surface chemical steps will be provided. In particular it will be demonstrated how *in-situ* Fourier Transformed Infrared Spectroscopy in combination with use of isotopically labeled $^{13}CO_2$ has contributed to revealing mechanistic details of conversion of CO_2 over a Cu(I)/TiO_2 catalyst (see Figure 1), and Ti-based catalysts incorporated in silica matrices, such as Ti-SBA-15 [2]. The role of carbonates, surface carbon deposits and the nature of the active sites will be discussed, as well as routes for development of improved catalytic formulations.

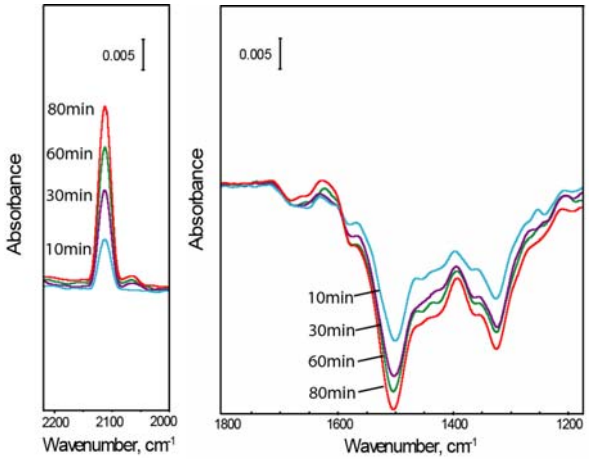

Fig. 1 Time-profiled FT-IR spectra of Cu(I)/TiO_2 preloaded with $^{13}CO_2$, and illuminated for 10, 30, 60 and 80 mins. Formation of CO is evident from the rise of the Cu(I)-CO band at 2117 (^{12}CO) and 2069 cm^{-1} (^{13}CO). Negative features in the region 1200-1800 cm^{-1} demonstrate decomposition of surface carbonates upon illumination.

E-mail: G.Mul@utwente.nl
www: http://www.utwente.nl/tnw/pcs

References

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