

Tuning the Selectivity of Photocatalytic Synthetic Reactions Using Modified TiO₂ Nanotubes

Jyotsna Tripathy, Patrik Schmuki

Department of Materials Science, WWW4-LKO

University of Erlangen-Nuremberg

Martensstrasse 7, D – 91058, Erlangen, Germany

jyotsna.tripathy@ww.uni-erlangen.de, patrik.schmuki@ww.uni-erlangen.de

Extended Abstract

Photocatalytic reactions of TiO₂ are widely used and explored for i) water splitting in view of H₂ production and ii) the destruction of environmental pollutants from water and air (Anpo et al., 2005, Fujishima et al., 1999, Hofmann et al., 1995, Linsebigler et al., 1995, and Serpone et al., 1989). Overall, photocatalytic synthesis is still in its infancy. This is mainly due to multitude of reaction pathways often including multiple radical formations.

Here, we grow TiO₂ nanotubes structures having 1-2 μm thickness by anodization of Ti in a glycerol/water/NH₄F electrolyte. The present work demonstrates the use of differently modified TiO₂ nanotubes to achieve a drastic change in the selectivity of a photocatalytic reaction. The oxidation reaction is carried out in presence of oxygen under UV irradiation (UV laser λ=325nm, 50 mW/cm²). We show that depending on the electronic properties of TiO₂ (anatase, rutile, metal-doped) a strong change in the main reaction product can be achieved and certain undesired reaction pathways can be completely shut down.

References

- Anpo M., Dohshi S., Kitano M., Hu Y., Takeuchi M., Matsuoka M. (2005) The Preparation and Characterization of Highly Efficient Titanium oxide-based Photofunctional Materials. *Annu. Rev. Mater. Res.* 35, 1-27.
- Fujishima A., Hashimoto K., Watnabe T., (1999) "TiO₂ Photocatalysis, Fundamentals and Applications" Bkc Inc. Tokyo.
- Hofmann M. R., Martin S.T., Choi W., Bahnemann D.W. (1995) Environmental Applications of Semiconductor Photocatalysis. *Chem. Rev.* 95, 69-96.
- Linsebigler A. L., Lu G., Yates J. T. (1995) Photocatalysis on TiO₂ Surfaces: Principles, Mechanisms, and Selected Results. *Chem. Rev.* 95, 735-758.
- Serpone N., Pelizzetti E. (1989) "Photocatalysis – Fundamentals and Applications" Wiley, New York.