Proceedings of the 5th International Conference on Nanotechnology: Fundamentals and Applications
Prague, Czech Republic, August 11-13, 2014
Paper No. 141

Tuning the Selectivity of Photocatalytic Synthetic Reactions Using Modified TiO_2 Nanotubes

Jyotsna Tripathy, Patrik Schmuki
Department of Materials Science, WWW4-LKO
University of Erlangen-Nurenberg
Martensstrasse 7, D – 91058, Erlangen, Germany
jyotsna.tripathy@ww.uni-erlangen.de, patrik.schmuki@ww.uni-erlangen.de

Extended Abstract

Photocatalytic reactions of TiO_2 are widely used and explored for i) water splitting in view of H_2 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 TiO_2 nanotubes structures having 1-2 µm thickness by anodization of Ti in a glycerol/water/NH_4F electrolyte. The present work demonstrates the use of differently modified TiO_2 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/cm^2). We show that depending on the electronic properties of TiO_2 (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) "TiO_2 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 TiO_2 Surfaces: Principles, Mechanisms, and Selected Results. Chem. Rev. 95, 735-758.

Serpone N., Pelizzetti E. (1989) "Photocatalysis – Fundamentals and Applications" Wiley, New York.

.