TiO2 nanotubes and mesosponges: Modification approaches to a strongly enhanced water splitting activity

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Photocatalytic reactions on TiO2 have over the last 30 years attracted tremendous scientific and technological interest. A main research direction using TiO2 based materials is still a use for direct splitting of water into H2 and O2 to generate the potential fuel of the future, hydrogen. In order to achieve a maximum turn-over rate (by creating a high surface area),usually nanoparticles are used either suspended in the reaction environment or compacted to a photoelectrode. Over the past decades various 1D and highly defined TiO2 morphologies were explored for their photocatalytic performance and were found in many cases superior to nanoparticles. This includes nanotubes or wires grown by hydrothermal or template methods, or by anodic oxidation. Several of these advanced morphologies can directly be grown on conductive substrates such as wires, rods or self-organized anodic structures and therefore can be directly used as photo-anodes. The presentation will focus mainly on the aspects of recently synthesized advanced nanostructures (namely, highly ordered nanotube arrays or mesosponge structures). water splitting potential. Fabrication of the nanostructures and aspects of self organization and novel modification approches will be discussed., and use of the structures to significantly enhance their H2 production yield.