FORMATION AND FUNCTIONAL FEATURES OF SELF-ORDERED TIO2 NANOTUBE ARRAYS

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Abstract

TiO2 nanomaterials have over the last 30 years attracted tremendous scientific and technological interest. Main research direction using TiO2 in functional applications are still the use in photocatalysis e.g. for the direct splitting of water into H2 and O2 to generate the potential fuel of the future, hydrogen, or the use in Grätzel type solar cells. In order to achieve a maximum turn-over rate (by creating a high surface area), usually nanoparticles are used either suspended or compacted to a photoelectrode. Over the past decades various 1D and highly defined TiO2 morphologies were explored for the replacement of nanoparticle networks and were found in many cases far superior to nanoparticles. Nanotubes or wires can be grown by hydrothermal or template methods, or even more elegantly, by self-organizing anodic oxidation. The latter is not limited to TiO2 but to a full range of other functional oxide structures on various metals and alloys can be formed. These advanced and doped morphologies can be grown on conductive substrates as ordered layers and therefore can be directly used as functional electrodes (e.g. photo-anodes). The presentation will focus on these highly ordered nanotube arrays of TiO2 and discuss most recent progress in synthesis, modification and applications.

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