Abstract

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Title: Titanium dioxide nanostructures for sensorics and photocatalytic applications

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Field of study: 4.1.3 Condensed matter physics and acoustics

In the last decades, nanotubes based on dioxide titanium became a very perspective material for research. Properties of nanotubes based on titanium dioxide are promising for electrochemical, catalytic, and sensory applications. The key to the latter two applications lies in the electronic structure of the material with a large bandgap of 3 eV, suitable band-edge positions for many redox reactions, a comparably high lifetime of excited electrons, and an exceptional photo corrosion resistance. To expand the applications of titania nanostructures in the fabrication of chemical sensors there are a number of parameters that need to be improved, namely the conductance of TiO_2 in air, the sensing signal, the response, and the recovery times. One of the ways to improve the sensory and photocatalytic properties of titanium dioxide nanotubes is doping with valve metals.

Mo and Fe have been found to be a promising dopant to improve the photocatalytic performance of TiO_2 by changing crystal structure. Ti^{4+} in the TiO_2 lattice can be replaced by Mo^{6+} because they are ionic radiuses are similar (Mo^{6+} 0.62 Å, Ti^{4+} 0.68 Å). Iron metal ions also were considered as a suitable candidate for doping since the radius of Fe^{3+} (0.64 Å) and Ti^{4+} (0.68 Å) is the same in size. Therefore, it can be easily incorporated into the TiO_2 crystal lattice and is an also good candidate for Ti alloying.

Therefore, the aims of our project are:

- obtaining the optimal structure of the precursor layer
- improving conditions of the anodic oxidation
- determination of a suitable temperature regime for annealing in a hydrogen atmosphere
- investigation sensing and photocatalytic properties of obtained nanotubes.

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