

Streszczenie (ENG)

The following dissertation contains a comprehensive study of the synthesis steps necessary to create electrodes for water electrolysis based on titania nanotubes using scalable processing and modification techniques. The presented work is divided into three chapters, each outlining one of the crucial steps of the process. The first chapter delves into the mechanism of the formation of titania nanotubes, as well as the analysis of parameters critical for their growth. It further analyzes the size-dependent effects of the nanotubes based on the experimental data. Chapter two discusses the interactions of the pulsed nanosecond laser with the matter, and consequently, with the titania nanotubes. The impact of three different laser wavelengths is analyzed and the physical changes in the material are noted. Moreover, the novel method for creating titania capsules from the nanotubes is described. The final chapter discusses the basis of electrochemical water-splitting and the requirements for the electrode materials. The obtained, laser-treated electrodes covered with transition metal species are evaluated for hydrogen- and oxygen evolution reactions. Moreover, the theory encompassing the role of the particular metal species as well as the effects of the laser treatment is derived from the experimental results and literature data. The findings of this dissertation can be used to design and produce more efficient electrodes while utilizing commonly available technologies.

