ALD-made TiO_2 layers on titania as a method for activity improvement in photocatalytic reactions

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The most popular materials in photocatalysis are transition metal oxides. TiO_2 is one of the most popular semiconductors used in these reactions due to its high photoactivity upon ultraviolet light irradiation, stability and lack of toxicity. Unfortunately, the use of UV irradiation is associated with many difficulties. To surpass them, titanium(IV) oxide is often modified by organic ligands to absorb light in the visible range [1]. However, low photostability of organic modifiers under irradiation conditions is a significant drawback of such systems. The protection of such systems can be obtained by an additional thin layer of TiO_2 placed on a modifier. The influence of such layers (deposited by ALD – Atomic Layer Deposition method) can be interesting in both aspects: photoactivity and photostability. Also their effect on bare titanium(IV) oxide can be really astonishing. The additional coating enhances the activity of TiO_2 in the VIS range. This feature can be connected with introduction of new electronic states created at TiO_2-TiO_2 interface responsible for extended VIS absorption.

We will present the influence of different thicknesses of thin titanium dioxide layers applied on two kinds of commercially available TiO_2 – Hombikat UV100 and Evonik P25, including their influence on specific surface area, XRD pattern and morphology. Our most interesting results of photoelectrochemical measurements, photoactivity tests, diffuse reflectance spectroscopy and diffuse reflectance spectroscopy coupled with electrochemistry used to determine the distribution of electronic states close to the conduction band [2] will be presented and discussed.

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References:

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