ALD growth of MoS_2 nanosheets on TiO_2 nanotube supports

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The success of graphene opened a door for a new class of chalcogenide materials with unique properties that can be applied in the semiconductor technology. Monolayers of two-dimensional transition metal dichalcogenides (2D TMDCs) possess a direct band gap that is crucial for optoelectronic applications. Additionally, the direct band gap can be easily tuned by either chemical composition or external stimuli. Next to the optoelectronic applications, where a monolayer planar structure is necessary to employ, a layer of standing flakes, which possesses a large surface area, can be used for hydrogen evolution a photodegradation of organic dyes or as electrodes in Li ion batteries. MoS_2, a typical representative of TMDCs, has been widely studied for many applications. Recently, the possibility to employ ALD as a technique to grow MoS_2 has been reported.

The self-organized TiO_2 nanotube (TNT) layers have attracted considerable scientific and technological interest over the past 15 years motivated for their wide range of applications including (photo-) catalysis, hydrogen generation and biomedical uses. The synthesis of the 1D TNT layers is carried out by a conventional electrochemical anodization of valve Ti metal sheets in various electrolytes. The main drawback of TiO_2 is its applicability in the UV light (wavelengths < 390 nm), thus TNT layers are often coated or decorated with secondary materials. In the recent years, it has become clear that atomic layer deposition (ALD) is the only approach that enables the possibility of coating high aspect ratio structures homogeneously with thin and ultrathin layers of secondary materials. The presentation will focus on the decoration of TNT layers with MoS_2 by ALD, their characterization and applications in various fields. Experimental details and some recent photocatalytic and battery results will be presented and discussed.

Speaker Biography

Hanna Sopha graduated in chemistry at the University of Rostock (Germany) in 2008. After she received Ph.D. degree in analytical chemistry from the University of Ljubljana (Slovenia) in 2013, she joined the University of Pardubice (Czech Republic) as a postdoctoral research fellow in electroanalytical chemistry. Since 2015, she has been working at the Centre of Materials and Nanotechnologies of the same university. Her research is focused on the anodization of valve metals towards novel nanotubular and nanoporous structures, as well as application and functionalization of these structures. She has over 40 publications that have been cited over 400 times, and her publication H-index is 14.

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