On Demand

Nanostructure Synthesis and Fabrication
Room On Demand - Session NS2

Nanotubes, Nanowires, Nanopores

NS2-1 Atomic Layer Deposition for Modification of Various 1D Nanomaterials, *R. Zazpe, H. Sopha, M. Motola,* Uni Pardubice, Czechia*; M. Rihova,* Brno University of Technology, Czechia*;* ***Jan Macak,*** Uni Pardubice, Czechia

One-dimensional nanomaterials – materials with one dimension outside the nanoscale, further noted as 1D NMs – represent a class of very important nanomaterials with continuously increasing importance. Due to their intrinsic features, unique properties and diversity of functionalities, they count among the most widely studied materials nowadays. While considerable research efforts have been spent to synthesize various 1D NMs (e.g. nanopores, nanotubes or nanofibers), limited efforts have been devoted to surface modification and property tailoring of these materials.

However, it is their surface that comes into direct contact with various media (air, gases, liquids, solids) and influences the reactivity, stability and biocompatibility of these materials. The surface and aspect ratio (defined as their diameter to length ratio) influence the performance of these materials in various applications. Considering these facts, it is more relevant to tailor the surface of these materials and to be able to influence their properties and reactivity at the nanoscale, rather than to deal with tailoring their own bulk material composition.

The focus of this presentation is on the modification of two types of 1D nanomaterials – nanotubes and nanofibers. Numerous techniques can be utilized for this purpose, such as for example wet chemical or physical deposition techniques. However, it is only the Atomic Layer Deposition (ALD) that is capable of really uniform and homogenous coating of these 1D nanomaterials, in particular those of very high-aspect ratio.

The presentation will be mainly focused on modification of TiO_2 nanotube layers and various nanofibers of different aspect ratios via ALD.

Experimental details and some very recent application examples [1-9] and structural characterizations of these modified materials will be discussed.

1. H. Sopha et al (2017), *Appl. Mater. Today*, *9*, 104.
2. H. Sopha et al. (2018), *Electrochem. Commun.,*97, 91.
3. S. Ng et al. (2017), *Adv. Mater. Interfaces*, 1701146.
4. F. Dvorak et al. (2019), *Appl. Mater. Today,* 14, 1.
5. H. Sopha et al. (2019), *FlatChem* 17, 100130.
6. M. Motola et al. (2019), *Nanoscale* 11, 23126.
7. S. Ng et al. (2020), *ACS Appl. Mater. Interfaces,* 12, 33386.
8. M. Motola et al. (2020) *ACS Appl. Bio Mater.* 3, 6447.
9. M. Rihova & M. Knez & J. M. Macak et al. (2021), *in preparation*

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