



Dipartimento
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Subject: Critical evaluation of the habilitation thesis of Mgr. Martin Motola, PhD., entitled “Anodic TiO₂ nanotube layers: past accomplishments and future perspectives”

The main part of this habilitation thesis is around 30 pages, while more than 200 pages are dedicated to Annexes, including original pdf of published articles, tables, list of abbreviations, etc.

Dr. Motola spent several periods abroad during his academic career working in world-leading laboratories for the fabrication and utilization of titanium dioxide nanotubes (TNTs). This has resulted in a significant scientific production with many research articles published in Q1. Furthermore, the experienced gained during these years served to Dr. Motola to implement his own research lines at Comenius University, which is testified by several papers recently papers where Dr. Motola is the last and corresponding author of the works.

According to WoS database, Dr. Motola published 58 research articles and 8 reviews, featuring a H-index of 18 will all works cited 963 times. This score is quite impressive considering the very young career we are evaluating, only 7 yrs.

The habilitation thesis is well organized and the content and discussions forming the main part of the work are of high quality with no additional notes on my side.

However, I found that this thesis could be substantially expanded as there is a clear mismatch between the main body of the thesis (i.e. Introduction and discussion of research) and the Annexes presented in the last part of the thesis, which seems forming the majority of it. Considering the significant scientific production of Dr. Motola, I believe that the body of thesis should be improved and expanded to show the ability to summarize and highlight the research findings presented in the Annexes, a peculiar skill requested to be Associate Professor. I will argument in detail now.

The body of the thesis is focused on TNTs and three aspects of related research:

- 1) Single- vs double-wall TNT layers
- 2) Large-scale TNT layers
- 3) Nitrate-based aqueous electrolytes as an alternative

The first point show how to control the morphology of the nanotubes, crucial for functional applications. The second point is very interesting as it enables to scale the use of TNTs from lab to real devices and it is a very original contribution. The third one is again very important in terms of laboratory safety and environmental aspects.



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Having said the merits of this habilitation thesis, I believe that two sections are missing to provide a more comprehensive summary of Dr. Motola work. One point is related to the use of atomic layer deposition-ALD, which is a very efficient tool to functional high-aspect ratio nanostructures like TNTs. Considering the large number of research articles published on the use of ALD by Dr. Motola, I suggest to include a section of TNT functionalization – fundamentals of the techniques, challenges of functionalizing TNT with other methods and what ALD provides.

Furthermore, I believe the actual version of the thesis demonstrate the strong background of Dr. Motola in TNTs fabrication and his mastering in controlling anodization technique to growth inorganic nanostructures. However, an important part of the puzzle – for instance which unlocks the possibility to apply and win research grants – is to find an application to the fabricated materials. It is without doubt that TNTs have a myriad of interesting applications, however, this aspect does not come out reading the thesis. As I see from publications, Dr. Motola published many works exploring several applications such as photoelectrochemistry, photocatalysis, solar cells, bio-oriented utilizations of TNTs, and others. Therefore, it is advised to include a section on applications, again outlining some fundamental aspects of them and what utilization of TNTs brings to them, as reported in the published papers.

Overall, the submitted habilitation will fulfil the requirements set out for habilitation theses, provided that it will be expanded following the above mentioned suggestions (insertion of two sections discussing TNTs functionalization and various applications).

Sincerely,

Prof. Alberto Naldoni