

## Supervisor's report

Academic year: **2022/2023**

Student: **Mahnaz Alijani**

Doctoral programme: **Advanced materials and nanosciences**

Field of study: **Advanced Materials**

Supervisor: **Dr. Ing. Jan Macák**

**Title of doctoral thesis:** Electrochemical synthesis, characterization and applications of new types of 1D valve metal oxide nanostructures

### **Overall evaluation of the doctoral thesis and study period of the doctoral student:**

Ms. Mahnaz Alijani began her Ph.D. at CEITEC in February 2019 under my supervision. Her activities and Ph.D. thesis have been devoted to the optimization of the growth high aspect ratio (HAR) TiO<sub>2</sub> nanotubular layers (TNTs), focused on achieving the growth in a very short time and their subsequent use in applications.

Throughout her study, the nanotube layers in the as-produced state or in the modified state (with some other materials) were used in batteries, photocatalysis and microwave sensing applications. Thanks to our cooperation network, it turned out that the most investigated application of TNTs she developed was in microwave planar resonators (used for the light detection). This in particular, because she pursued her internship in the Okanagan Microelectronics & Gigahertz Applications Lab (OMEGA Lab) at the University of British Columbia, Canada. Her visit aimed on investigations of the microwave sensors with HAR TiO<sub>2</sub> nanotubes. **Four high profile papers were published as outputs of this internship, which is an admirable achievement considering the duration of the stay (nearly 1 year).**

In terms of competences and soft skills, she has widely broadened her knowledge and overview in materials science, material chemistry and electrochemistry. She has an excellent knowledge and ability to prepare different types of tubes, but also to carry out etching experiments of the nanotubes (yielding single wall nanotubes) and decoration of nanoparticles (increasing further the specific surface area). She could support some of the other team member's activities by these processes and that resulted into publications of other articles. She has also mastered SEM, XRD, and EDAX operational skills.

**Up to this final stage of her Ph.D. study, she has been very successful in all planned experiments and in fulfilling her specific goals described above. As a result, she could have realized an outstanding number of high-profile publications, as listed in her thesis. She was also extremely successful in obtaining students grants to support her study also from the financial**

**point of view. Moreover, she presented her results on several international conferences.**

Based on fulfillment of all study requirements, including courses, she successfully passed her state doctoral exam in 2022. In the most recent student evaluation (Dec. 2022) she received the highest mark (A1) for outstanding performance and results.

She authored or co-authors more than 10 papers, and more are on the way. Based on this fact, I supported her in writing “paper-based” thesis, instead of “full” thesis. The thesis is written according to BUT standards, it is comprehensive, clear and instrumental. She also very precisely described her contribution in all those articles.

**All in all, I consider the study of Mahnaz as a very nice success story and I fully support her doctoral thesis for acceptance and her study to be approved as finished.**

**I am very sure that in her junior doctor career, either as a postdoctoral researcher, or on any other position, Mahnaz will perform very well and will successfully boost her scientific profile. Currently, she has been waiting for the result of one GAČR project proposal submitted (PostDoc Outgoing) and is preparing Marie Curie Skłodowska Action proposal.**

Sincerely

Dr. Jan Macák

Brno, date 21.7.2023

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Dr. Ing. Jan Macák