Faculty
of Science

Opponent's Review of the Habilitation Thesis of

M.Sc. Rafael Omar Torres-Mendieta, Ph.D., Technical University of Liberec, Faculty of Mechatronics, Informatics and Interdisciplinary Studies

Thesis entitled: **Laser-mediated manipulation of matter at the nanoscale**

Habilitation field: **Applied Sciences in Engineering**

The habilitation thesis submitted here is composed of a compilation of 12 published scientific works (5 as a first or corresponding author), accompanied by a commentary, following Act No. 111/1998 Coll. on Higher Education and Amendments and Additions to Other Acts (Act on Higher Education). This compilation presents the results of the scientific research conducted by Dr. Torres-Mendieta, with a focus on the application of lasers in the synthesis and modification of nanomaterials. The emphasis lies particularly on the development of new ways of application of high-power pulsed lasers for the preparation of functional materials. The habilitation thesis is divided into three basic parts based on the field of the changes in nanomaterials produced by interaction with laser.

The first part is focused on the element's rearrangement via the interaction of nanoparticles with a laser. The main interest is devoted to the formation of heterostructures between semiconductors and metals, described in the example of forming silver nanostructures inside silver tungstate. The second part is aimed at the formation of heterojunctions and alloys. Highly interesting results are reported especially in the field of formation alloys of metals with poor miscibility, e.g. iron and copper. The third part of the thesis is aimed at nanomaterial morphology control this time described on the real example of the formation of different particles of iron-based compounds via laser interaction with iron source in different solvents.

The text of the habilitation thesis clearly demonstrates not only the high professional quality of Dr. Torres-Mendieta's scientific work but also his high educational quality. The Introduction part of the text and the start of all other chapters are very good introductions to the discussed problems. Especially Chapter 5 Nanomaterials morphology control is a nice example of the educational professionality of the author. Also, the formal aspect of the text is commendable, especially the high quality of graphical artwork (the same quality as can be seen in the referred articles).

In the context of the presented scientific works, it is also appropriate to emphasize, from the point of view of the habilitant's professional quality, that out of a total of 37 published scientific works (WoS), he has participated in 9 publications as the first author and in 6 as the corresponding author. Even considering the citation response of these scientific publications (614 citations WoS, H-index 15), it can be concluded that Dr. Torres-Mendieta meets the professional criteria for a successful habilitation procedure in his scientific field.

The above-mentioned facts prove that MSc. Rafael Omar Torres-Mendieta, Ph.D. demonstrates high professional activity at his university workplace, and therefore I recommend that the submitted habilitation thesis be accepted for further discussion before the Scientific

Board of the Faculty of Mechatronics, Informatics and Interdisciplinary Studies of Technical University of Liberec in the context of the procedure for awarding the scientific and pedagogical title of Associate Professor in the sense of the currently valid wording of Act No. 111/1998 Coll. on Higher Education.

Question for the discussion on the topic of the habilitation thesis:

1. Research results on element rearrangement in nanocomposites is an interesting task of nanomaterial technologies. In the thesis, this problem is discussed with examples of silver and bismuth. However, can be lasers used also for other metals?
2. Many interesting topics are reported in the thesis. Maybe some specialization should be taken into account. Which topic from these will be the most attractive for the specialization of the future research work?

In Olomouc, February 15, 2024

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