

# Review Report on PhD Thesis

Faculty: **Central European Institute of Technology  
Brno University of Technology in Brno**

Academic year: **2019/2020**

Student: **Jorge Alberto Torres Rodríguez**

Doctoral study program: **Advanced Materials and Nanosciences**

Field of study: **Advanced nanotechnologies and microtechnologies**

Supervisor: **prof. Ing. Jozef Kaiser, Ph.D.**

Reviewer: **prof. Sebastián Díaz de la Torre**

PhD thesis title: **Processing of aerogel coatings on bulk materials substrates**

## Topicality of doctoral thesis:

Undoubtedly, the issue of aerogels is of current relevance and great value in the field of advanced materials science, specifically in nanotechnology.

## Meeting the goals set:

This thesis work fulfills well the proposed goals.

## Problem solving and dissertation results:

Considering that this thesis is directed at the laboratory level, and not industrial, most of the challenges posed, such as achieving the synthesis and characterization of oxide and lanthanum coatings, were successfully achieved.

It is important to give the corresponding credit to the authors of this work, for the simple fact of having designed and built an effective reactor-type chamber for the synthesis of aerogels. Although, this design could be seen as one of simple engineering, it should be noted that such system allows manipulating both the pressure and temperature variables of the reactor or autoclave up to high pressure ranges and can bring the experimental conditions to the triple (super) critical drying point, which is of great valuable and innovative. This reactor should be patent-submitted.

### **Importance for practice or development of the discipline:**

After considering the results of this R & D work, it is suggested to continue it and try focusing on developing aerogels and coatings of this type having larger coating-surfaces. The application market for this type of materials, extremely insulating (acoustic and thermal) can be of great economic value.

### **Formal adjustment of the thesis and language level:**

This reviewer finds this study nearly completed and strongly recommends the author to have his manuscript approved by a native English-speaker, not the contents but the grammar, since similar to this thesis author, the reviewer is not an authority in the language. Nevertheless, the thesis manuscript is found of sufficient level as to proceed doctoral examination and the dissertation defense.

Judging from the list of derived publications, one can expect that the author of this thesis seems to have reached the ability and readiness for conducting independent activity in research or development in his field.

Although the results derived from this research have been presented systematically, this reviewer believes that the manuscript might be missing a confrontation of the results against other similar works previously published. That is, it might be convenient to give more enhancement / value to the products achieved from this thesis, provided that there are equivalent works, via a technical comparison. For example; to compare the effect of the grain size of the microstructures of the materials thus produced versus those of their counterparts.

### **Questions and comments:**

It is suggested to edit the paragraphs placed immediately after the plots, graphs and pictures, so that the foot text can clearly describe the information disclosed with no need to fully refer to the text. For example, the text found under Fig.4.12, should be more self-descriptive.

Next, few possible questions to be expressed to the doctor-student, during his oral defense:

- What was your motivation to attend a doctor course program in CEITEC-Brno, if there are a number of prestigious institutions all over the planet, for instance your own homeland, among many others?
- Why in the acknowledgements section of your thesis book, you did not acknowledge any people from Mexico, besides your wife and son?. Who originally introduced you to CEITEC, to the aerogel field?
- Usually, after receiving the doctor's diploma from the BUT-CEITEC, any graduated become a sort of academic Czech Republic-ambassador in his own country, how do you plan to contribute to the enhancement of academic/cultural/business bilateral activities between Czech Republic and Mexico?

- Are you aware of the fact that your scientific and technical contribution derived from your thesis work now belongs to BUT-CEITEC? and therefore whenever you might think of doing any business using its content is under this University rights protection?. How could you proceed if a foreign enterprise will ask you to reproduce such invention for their/your own benefits?
- How could it be possible to move you laboratory-level process to the pilot- or even more industrial-level for business?. That is, do you think is it possible to redesign your lab-scale process to an industrial level?, what would you modify?.
- The aerogel technology is practically worldwide based in  $\text{SiO}_2$  ceramics, in your doctoral thesis you have introduced  $\text{ZrO}_2$  and other lanthanum compounds, can you mention the main advantages in doing so and why?.
- What is the reason why most  $\text{ZrO}_2$  ceramics break apart when exposed to thermal shock or mechanical forces?
- Why is  $\text{ZrO}_2$  is considered the *Ceramic Steel*?
- What is the heat transfer coefficient value of  $\text{SiO}_2$ ,  $\text{ZrO}_2$ , YSZ,  $\text{Ln}_2\text{Zr}_2\text{O}_7$ .
- What is the main thermal effect (response) by replacing  $\text{La}^{3+}$  for  $\text{Nd}^{3+}$ ,  $\text{Gd}^{3+}$ , and  $\text{Dy}^{3+}$  ?.
- Can you describe the crystallite size effect versus the pore size of your aerogel coatings?
- If you could have the chance to speak directly and honestly to our BUT rector, what kind of suggestions would you express in order to improve the quality conditions for attaining the most potential as graduate professionals?.

#### Conclusion:

In my opinion, the reviewed thesis nearly fulfills all requirements posed on theses aimed for obtaining PhD degree. After the author has considered and adjusted the above comments, this thesis is ready to be defended orally, in front of respective committee. Therefore, if this student of the doctoral study program successfully defends his thesis, I do recommend to award him by the deserved title of Ph.D.

Mexico City, January 28th, 2020. <sub>5</sub>

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