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Review of Habilitation Thesis of Dr. P. Minárik

Dear prof. Doležal,

I am writing you with my review of the Habilitation Thesis submitted by Dr. P. Minárik. I am familiar both with the subject of Dr. P. Minárik's research and also with much of his published work. In fact, due to his origin being born in Martin near Žilina, Dr. Minárik spent a lot of time in our laboratory already as a student as his subject of research work was closely related to our activities, namely in the area of corrosion and mechanical properties of commercial magnesium alloys. He closely collaborated with my colleague, prof. B. Hadzima and his students and PhD students in their research activities. Later as a PhD student and postdoc, he continued his collaboration with my colleagues and our students and also brought his students to our department, which even further extended mutual collaboration and exchange of research capacities of our and his group, which continues up to the present time. Next to Dr. Minárik's research activities, I am also very familiar with his research publications, some of which are even joint publications with prof. Hadzima and other my colleagues and with his research output in general. I consider him to be an international expert in his field of study. His publications and conference presentations in which I participated were always of the highest standard and stimulated quite extensive discussions in the audience.

Dr. Minárik has undertaken research related to the development of Mg alloys for biomedical applications, namely to design alloys for biodegradable and bioresorbable body implants like cardiovascular stents, small screws, wires or pins, and also on larger load-bearing implants designed for orthopaedic applications. The principal scientific efforts in this respect were threefold, namely to control the degradation rate, to achieve high strength and low texture. All of them were addressed in the research work of Dr. Minárik and unambiguously demonstrate that he has selected topics that are considered in the magnesium community to



be among the most exciting and most probably to result in new scientific knowledge and evidence and technological progress. In his publications, Dr. Minárik indeed described a number of these scientific advances which he achieved.

The habilitation thesis of Dr. Minárik is a collection of 9 scientific papers and is thematically divided into two parts. The first part summarizes the results achieved in Al-containing magnesium alloys and includes 5 papers discussed in subsections 2.1 – 2.4. The research effort was focused on the enhancement of the corrosion resistance and mechanical strength by grain refinement achieved by severe plastic deformation (ECAP) and on the relation between the microstructure changes and the degradation rate of the material. The main achievement of this complex research was the processing of the non-commercial LAE442 magnesium alloy by ECAP, which resulted in excellent *in vitro* degradation properties in biologic media and cytocompatibility, high strength and weak texture. This novel achievement has been fully accepted by the magnesium scientific community, as proved by papers PM2-PM5 of the thesis. The explanation of texture formation and development in the LAE442 magnesium alloy processed by ECAP was a completely new result of exceptionally high scientific importance, which is currently fully accepted in the Mg community and also observed in novel magnesium alloys.

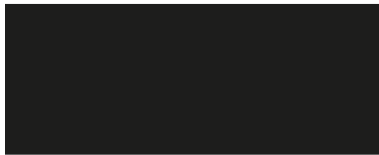
The second part of the thesis consisting of 4 papers, discussed in subsections 3.1 – 3.3, describes the research activities of Dr. Minárik in the group of Al-free alloys. Due to some concern about the toxic effect of Al on the human body, the research efforts of the scientific community have moved to this class of alloys. New promising results were obtained on the group of Mg-Y-RE-Zr alloys being based on the commercial WE43 magnesium alloy. The main aim of Dr. Minárik in this respect was to improve the physical properties of the WE43 magnesium alloy and to develop novel Al-free magnesium alloys with properties superior to those of the WE43. Even if the research is currently still in progress, Dr. Minárik has demonstrated exceptional grain refinement, weak texture and enhanced strength in WE43 alloy. In this condition, the alloy exhibited excellent thermal stability, which resulted in high strain rate superplasticity and record elongations exceeding 1000% at the strain rate of $10^{-1}/s$ (paper PM8), which have not been reported before and as far as I know nor broken up to now. Currently, the development of the new Al-free biodegradable Mg alloys continues and Dr. Minárik has achieved new promising results in ultrafine-grained Mg-Y and Mg-Y-Li alloys which exhibited enhanced *in vivo* and *in-vitro* degradation behaviour. These studies, even if they are not included in the Habilitation thesis, but are well known from his recent publications, serve to confirm the scientific excellence of Dr. Minárik's professional activities. The topic of biodegradable magnesium alloys is currently highly relevant and Dr. Minárik has proved that he is highly capable of leading investigation in this area at the highest professional level.



My check of plagiarism raises no problems or issues.

In summary, it is clearly evident that Dr. Minárik is a highly respected scientific researcher and a mature academician. His contribution to the scientific community working in magnesium is highly appreciated. Dr. Minárik is extremely creative in the selection of research and its execution. He undertakes the investigation in a manner involving scientific and technical excellence at a world-class standard. I am sure that in the future, Dr. Minárik will find new research topics and many scientific and industrial partners assisting him in world-class execution of his research. In my numerous personal meetings with Dr. Minárik, I always appreciated his passion for science, his personality and his kindness. With my letter, I wish to clearly demonstrate that I have the highest opinion of Dr. Minárik and wish to recommend him enthusiastically in terms of his promotion to the professorial ranks without any reservations.

Yours sincerely



prof. Ing. František Nový, Ph.D.