

Report on the PhD. Thesis

Influence of Sc on properties of model Al-Li based alloys prepared by twin-roll casting

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The Thesis of RNDr. Rostislav Králík is focused on the effect of Sc on the structure of Al-Li based alloys which are intended for construction applications, and on optimization of their thermomechanical processing. For this aim, various processing routes such as severe plastic deformation and twin-roll casting have been used. The research on the materials is very intensive worldwide at present and in this respect, the *topic of the Thesis is very actual*.

The first Chapter of the Thesis – literature review – summarises present knowledge on the properties of Al alloys with Li, Cu, Zr, Mg and Sc, and on various casting methods differing in the cooling velocity. High number of references – 146 – related to this part shows that the author is familiar with the field in very detail. In the next Chapter, the author defines the main aim of the work and the ways how to realize it. The third Chapter is devoted to the description of the methodology used in author's experiments. The experimental work comprised of casting and processing of the chosen alloys, application of electron microscopy techniques for characterization of the materials microstructures, measurements of mechanical properties (microhardness and tensile tests), and their thermal and mechanical treatment. *The experimental techniques were chosen adequately to the focus of the Thesis* and suggests a very good experimental skill of R. Králík. Only one formal comment to this part – I would prefer to start with the sample preparation following by characterization and testing experiments but not locating the preparation part at the end of the Chapter. The fourth Chapter of the Thesis is devoted to the results and discussion. The results are described well and in very detail. *It is possible to state that the Thesis provides new original results* related to the relationship between the structure and processing of the Al-Li based alloys. This part is followed by the discussion summary, in which the results are generally commented. I did see such summary very rarely but consider it as very useful. The Conclusions briefly list the obtained results of the Thesis. This part might be more detailed as the author did reach many interesting results which deserve more extended accent.

I can conclude that *the Thesis fulfils the designated aim* and that *the author unambiguously proved his qualification for scientific work*.

The Thesis is written in English. It is systematically built and well readable. Unfortunately, some formal problems lower the quality of the Thesis. There is lot of empty space at some pages which could be better filled and organized. In Captions of Fig. 4.13, it is referred to Eq. 4.5, but I guess, it should be Eq. 4.6.? Images in some Figures, e.g. 4.17, 4.19, 4.26, are smaller than in other figures, which makes them less “readable”. What does mean the term “coarse nanoscale particles” (below Fig. 4.17)? Some images (e.g. in Fig. 4.24c) are less visible. Fig. 4.34d: what is the red area on the side surfaces – really {100} single crystals? In Table 4.22, I would prefer a more reliable rounding, e.g., not 39 ± 11 but rather 40 ± 10 .

I have no serious objections to the Thesis. I only have following points/questions for discussion during the Thesis defence:

- 1) Part 4.1.1.: Fig. 4.1 shows grain orientation maps: How the sample was oriented relatively to the growth axis (parallel or perpendicular)? Does the figure show the orientation just in that plane or in another relationship to the growth axis? Is it the orientation of the images the same in all figures of this type?
- 2) How is the velocity R_D affected by presence and concentration of impurities?
- 3) Fig. 4.14: does Cu concentrate at grain boundaries or rather at triple junctions? Regarding the grain boundaries – does Cu appear at all grain boundaries or is there any specific orientation of the grain boundaries at which Cu does appear or does not appear?
- 4) P. 70, Fig. 4.35: discussion about abnormal grain growth: As I understand, the samples were deformed at 450°C. What was the total degree of deformation? Which mechanism of abnormal grain growth is active here (if it is really abnormal grain growth)?
- 5) Fig. 4.38: is it expected that – after 100 h of annealing – the values of HV remain constant?

Conclusion:

In summary, I can confirm that the topic of the Thesis is actual, the chosen experimental techniques were adequate to the focus of the Thesis, the Thesis provides new original results, contributing to further progress of science, and the Thesis fulfils the designated aim. Therefore, I can conclude that the Thesis providing original scientific results fulfils all

requirements for successful PhD. Thesis. I am recommending this work for further procedure and after its successful defence, awarding RNDr. Rostislav Králík with the scientific degree PhD.

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