

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Yulia Kuzminova

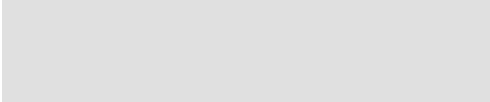
PhD Program: Mathematics and Mechanics

Title of Thesis: Properties and characteristics of the CrFeCoNi high-entropy alloys and its modifications produced by additive manufacturing technique

Supervisor: Associate Professor Igor Shishkovsky

Co-supervisor: Assistant Professor Stanislav Evlashin

Name of the Reviewer: Sergey Zherebtsov

I confirm the absence of any conflict of interest 	Date: 01.09.2023
--	-------------------------

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

The dissertation work is focused on structure and properties of a CrFeCoNi alloy produced by the powder bed fusion method. The topic is very interesting and actual. The applicant made a good piece of work using novel methods, including SBSD, TEM, neutron diffraction etc.. The thesis is scientifically correct; it contains some important findings. The most important result is associated with systematic investigation of the new CrFeCoNi alloy obtained by the additive manufacture method and the influence of various factors on structure and properties. A very high level of publications should be particularly emphasized; the list of publications included papers in such reputable journals as Intermetallics, Materials Science and Engineering A., Journal of Alloys and Compounds and Materials Letters. In general this work is very good, however some points deserve additional attention. Below are some specific questions and comments (they are also highlighted in thesis text sent to your supervisor):

Title. "PROPERTIES AND CHARACTERISTICS" What the difference? I would say characteristics may include properties, but in general those are nearly the same.

Page 11: "with/or without further intensive deformation process" Not clear. Why intensive (not usual for a start)? Please specify.

What is "in situ AM"? Why metal powder blend is cheaper? Is it about powder of pure elements? Please clarify.

Page 12: Why HPT? Why not usual rolling or compression?

"conventional hot-rolled process" Of what? Cast condition?

Chapter 2. "CrFeCoNi medium-entropy alloys" In the dissertation title this alloy defined as "high-entropy alloy"

Chapter 3. P 31. "sub-cell" cell structure is a sub-structure itself

Chapter 3. P 9 in the article. What type of recrystallization (continuous or discontinuous)? Why recrystallization does not result in microstructure refinemen, decrease in dislocation density and the texture weakening?

Chapter 4. P 2 in the article. "...water quenching to remove the residual stress" Normally water quenching can result in the appearance of residual stresses...

P 2 in the article. "further, "machined samples". Parameters of the processing, roughness of the surface?

P 3. “shows twins-like grains”. Are these twins or just elongated grains?

“exhibits a removal of the residual stress”. How misorientation can show the presence (or absence) of residual stresses?

P 10. “The twinning deformation mechanism takes place at the tensile deformation, while dislocation slip dominates at cycling loads of ~480 MPa.” I do not see any evidents of this conclusion.

Chapter 5. P 78. “nanostructured materials”. Why nanostructured? why not just fine-grained?

Chapter 6. Summary and Conclusions. How these results are related to the above results on the effect of recrystallization?

Chapter 7. P 3. “the annealing twins”. Where? How were they determined?

Conclusion. “At the as-built state, the ultimate strength characteristics are equivalent to hot-rolled materials and the yield strength properties are even higher.” Since the chemical compositions are not the same, may be it is not quite correct to compare these two conditions in the dissertation conclusion.

Please, check the grammar and typos. Some of them were highlighted in the thesis text sent to you through your supervisor.

Provisional Recommendation

I recommend that the candidate should defend the thesis by means of a formal thesis defense

I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report

The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense