

## 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:** Ivan Sergeichev

I confirm the absence of any conflict of interest  (Alternatively, Reviewer can formulate a possible conflict)	<b>Date: 25-08-2023</b>
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*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 thesis thoroughly examines high-entropy alloys produced through additive manufacturing, a topic of great relevance in the industry. While these alloys are relatively new, they have potential for industrial applications and have been extensively studied through traditional methods. Therefore, a detailed and systematic study of HEAs produced through AM techniques is crucial.

The thesis specifically focuses on the CrFeCoNi alloy and its minor additions of Al (Al+Ti). It comprises 10 chapters, beginning with an introduction that presents the current state of the field. Chapters 2-6 provide a detailed analysis of the four-component alloy, including optimizing the parameters of the powder bed fusion process, examining the effects of thermal and mechanical treatments on the alloy's structure and properties, and evaluating its structure and micromechanical properties under severe plastic deformation.

Chapters 7 and 8 concentrate on the influence of Al additions to the four-component alloy, analyzing their impact on the structure, phase composition, and oxidation resistance. Chapter 9 investigates the effects of both Al and Ti additions on the alloy's structure and properties in both as-built and heat-treated states. Finally, Chapter 10 offers conclusions and future perspectives.

Overall, the thesis is well-written and well-organized, demonstrating a thorough understanding of the research field's challenges and a solid grasp of methods and analysis. I provide a comprehensive evaluation of the thesis's quality and overall structure.

There are some issues to be clarified.

How do you explain the different results for the recrystallization process of AM HEA discussed in Chapters 3 and 6?

What happens with Ti addition in the material since such significant changes in mechanical properties are observed?

Except for the heat treatment application, are there any other ways to improve the element distribution in the PBF material printed with powder blends?

The thesis contains some typos and grammar mistakes.

#### **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*