

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Valentina Ekimova

PhD Program: Petroleum Engineering

Title of Thesis: Experimental modeling of gas hydrate interaction with salt solution in permafrost

Supervisor: Dr. Evgeny Chuvilin

Name of the Reviewer: Yongwon Seo

I confirm the absence of any conflict of interest

(Alternatively, Reviewer can formulate a possible conflict)

Date: 07-09-2022

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

This study investigated the influence of geomechanical conditions on methane hydrate stability and ion migration in the sediment pore space. The author found that the migration of salts in frozen sediments stimulates the hydrate decomposition in pore space and can accelerate ice thawing. The thesis was generally well written and the experimental results will be meaningful for an understanding of gas hydrate destabilization occurring in the Arctic region. The author needs to modify the thesis after carefully reviewing the following comments.

1. This thesis consists of relatively more chapters (9 chapters) than the normal thesis. Chapters 2-4 cover theoretical backgrounds and literature survey, so they can be combined into one chapter, "Chapter 2. Research back ground and literature survey" (You can choose the proper title).

Chapter 1. Introduction

Chapter 2. Research back ground and literature survey

Chapter 3. Method of experimental study....

Chapter 4. Mechanism and dynamics...

Chapter 5. Influence of the different...

Chapter 6. Concept models...

Chapter 7. Conclusion

2. Is it possible to predict the amount of salts migrated from the hydrate sample based on mass balance and the principle that salts are not included in the hydrate cages?
3. It would be better to add the experimental results for $C_{sol} = 0$ in Figures 35-37 for a better comparison.
4. In section 7.5, the reason for more active salt accumulation and hydrate dissociation in the sand with kaolinite particles than in the sand with montmorillonite should be discussed in more detail.

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