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Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Anastasia Gabova

PhD Program: Petroleum Engineering

Title of Thesis: Experimental investigations of thermal properties of unconventional hydrocarbon reservoirs at formation temperatures

Supervisor: Professor Yuri Popov
Co-supervisor: Dr. Evgeny Chekhonin

Name of the Reviewer: Professor Sergey Stanchits

I confirm the absence of any conflict of interest	**Date: 22-12-2021**

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

In her Ph.D. thesis, Anastasia Gabova presented the study of thermal conductivity measurements of organic-rich rocks from various unconventional formations at elevated temperatures. A novel technique allowed measuring a thermal anisotropy and heterogeneity of the rocks, as well as improving the quality of the experimental data collected in a temperature range of 30-300 ºC. In her study, Anastasia has found a strong correlation between the coefficient of linear thermal expansion, thermal conductivity and total organic carbon, she also measured the anisotropy of rock thermal expansion and thermal conductivity. In total, more than a hundred rock samples from seven oil fields were studied, thus allowing Anastasia to find the relationships between thermal properties and the temperature of the matrix.

The thesis is well-written, 128 pages long, contains five chapters, including a detailed literature review, description of research methods for measuring the thermal properties of solids and nonconsolidated rocks at elevated temperatures, description of obtained experimental results and conclusions. The content of the dissertation and the implemented methods are entirely consistent with the topic of the Ph.D. study.

I have a few questions to Anastasia Gabova related to the text of the thesis.

- The rock in reservoirs exists under elevated temperature and elevated stresses, and DTC-300 instrument is able to apply only a very small compressive load of 7 kPa to the sample, which is not enough to close all the cracks. How significant is the influence of stresses in comparison with the influence of the temperature on the thermal properties of the rock studied in Ph.D. thesis?
- I expect some cracking of rock samples to occur during the coring procedure, as well as during the lifting of the core samples from depth to surface. Is it possible to estimate how significant the influence of these artificially created cracks will be on the coefficients of linear thermal expansion and thermal conductivity measured under laboratory conditions?
- I think it is worth mentioning in the thesis how the results measured under laboratory conditions can be extrapolated to the reservoir conditions?
- In the “Conclusions” section, I would recommend Anastasia to specify – where can the results of her Ph.D. study be applied in Industry?

Overall, Anastasia Gabova has demonstrated her ability to make a detailed analysis of the results of measurements of thermal properties of rock cores collected from unconventional reservoirs. The results of her Ph.D. were presented at 15 International conferences and published in five papers, four of them are in the Q1 ranking journals. I would also like to mention that Anastasia is the first author of Russian patent. Summarizing above, I believe the candidate is qualified for a PhD degree.

Provisional Recommendation

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