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Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Tatiana Bondarenko

PhD Program: Petroleum Engineering

Title of Thesis: Evaluation of high-pressure air injection potential for in-situ synthetic oil generation from oil shale: Bazhenov Formation

Supervisor: Prof. Alexey Cheremisin

Chair of PhD defense Jury: Prof. Alexei Buchachenko ***Email:*** *a.buchachenko@skoltech.ru*

Date of Thesis Defense: December 03, 2018

Name of the Reviewer: Dimitri PISSARENKO

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Signature:** Pissarenko 26.11.2018 **Date: DD-MM-YYYY**

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 manuscript submitted by Tatiana Bondarenko entitled "Evaluation of high-pressure air injection potential for in-situ synthetic oil generation from oil shale: Bazhenov Formation" presents a well-structured quality PhD thesis work dedicated to a highly relevant topic of the petroleum engineering research and one of the modern technological challenges of the oil industry.

The manuscript is divided into five chapters which include Introduction, Literature Review, and Summary, Conclusions and Recommendations, as well as three chapters that constitute the core of the candidate's research work.

Introduction (Chapter 1) states the problem under consideration in the present thesis work, as well as the set of its principal objectives. Well-founded justifications are given as for the scientific value and the industrial relevance of the proposed study.

Literature review (Chapter 2) is thoroughly carried out and includes an objective summary of the prior art, as well as the synthesis of the current state of research and technology in the domain of thermal EOR methods. The author presents an extensive overview of the existing EOR technologies, and gives a critical analysis of their advantages and shortcomings.

Chapter 3 is dedicated to the laboratory experimental study of oil shale oxidation, pyrolysis and hydropyrolysis. This work represents a major advance in the experimental investigations and in the understanding of chemical reactions that occur in kerogen bearing low-permeability shale rock under the effects of high pressure and high temperature. The author describes different observed regimes of kerogen conversion as a function of the applied thermodynamical path, and gives a detailed analysis of the corresponding chemical reactions and of their kinetics. These results represent a major asset for the design of kerogen conversion EOR technologies, in particular the ones aimed at the hydrocarbon recovery from Bazhenov formation.

Chapter 4 reports the results of a laboratory study of high pressure air injection (HPAI) into kerogen bearing rock samples conducted on a unique combustion tube experimental set-up in Skoltech's CHR lab. The results of this study represent the basis for the definition of the chemical reaction model as a part of a complex numerical model of large scale (including reservoir-scale) HPAI. Such formulations are essential in order to interpret the observations of the ongoing HPAI field tests, and build quantitative predictive models for the assessment of the commercial potential of that technology.

The candidate has published 9 co-authored Russian and international journal papers and peer-reviewed conference abstracts. This set of publications confirm the significance of the obtained results and the international standing of the conducted work.

Overall, my conclusion is that the manuscript presents a top quality PhD thesis work dedicated to a highly relevant scientific and industrial research topic, and executed in compliance with the best international academic standards and practices. I recommend that the candidate defend the thesis before the Jury.

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*