Skoltech
Skolkovo Institute of Science and Technology

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Anastasia Ivanova

PhD Program: Petroleum Engineering

Title of Thesis: Dynamic modelling and experimental evaluation of nanoparticles application in surfactant enhanced oil recovery

Supervisor: Associate Professor Alexey Cheremisin

Name of the Reviewer:

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	**Signature:**  **Date: 13-11-2020**

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

- **Brief evaluation of the thesis quality and overall structure of the dissertation.**

The thesis titling: “Dynamic modelling and experimental evaluation of nanoparticles application in surfactant enhanced oil recovery” was evaluated. The thesis contains 6 chapters of experiments and modeling at Molecular dynamic scale. The first chapter is introduction chapters 2-3 are experimental work through which a novel and nice piece of research on characterization of oil layer on carbonate rock using ESEM/EELS/EDXS and S/TEM was evaluated in Chapter 2.

In Chapter 3 impact of nanoparticle on viscosity and IFT at high salinity and moderate temperatures have been investigated. The type of salt used in this chapter is NaCl and the range of salinity is 0-60000 ppm.

In Chapters 4-6 molecular dynamics of IFT of different conditions have been investigated.

Recommendations:

Chapter 2:

If possible by studying the effect of Surfactant and nanoparticle after treating like the one with toluene and kerosene this chapter will be completed and in the line with the main subject.

Simple contact angle measurements at normal thin section scale is recommended.

Chapter 3:

The stability of nanoparticles at higher salinity and higher temperature can be investigated in this chapter. Using other ions such as Ca^{+2}, SO_4^{-2}, can further complete the study.

Chapters 4-6:

These chapters are good enough, however, interaction of aqueous phase-oil-rock sample can be mentioned as a recommendation for future study by other students.

- **The relevance of the topic of dissertation work to its actual content**

It is well matched with the content of thesis, however, since no direct EOR flooding has been reported the following alternative title is suggested:

Experimental and Molecular Dynamic evaluation of nanoparticle application in surfactant/oil/carbonate rock system.

The advantage of this title are:

1. The kind of dynamic modeling (i.e. MD) can be obtained from

2. It is about interaction of fluid/fluid and fluid rock interaction rather than direct EOR
3. Since one nanoparticle has been used it is better to omit "s" in nanoparticles

- **The relevance of the methods used in the dissertation**

The experimental method (e.g. ESEM, EDXS, …) and equipment (e.g. spinning drop method) and the novel method of evaluation of contact angle measurement and also the method of modelling are relevant and proper.

- **The scientific significance of the results obtained and their compliance with the international level and current state of the art**

In this study, high tech equipment and software have been used, so the methodology and the obtained results are well at the international level.

- **The relevance of the obtained results to applications (if applicable)**

In this research, the effect of high salinity and moderate temperature on the results have been studied. Thus to some extend it can be said that the trend of the results could be in the line with the required one in practice and real conditions.

- **The quality of publications**

Four journal paper have been published a couple of them are Q1 others are Q3 and Q4.

Five international conferences are also published in good conferences such as SPE and EAGE.

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*