

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Ayomikun Bello Sunday

PhD Program: Petroleum Engineering

Title of Thesis: Co-optimization of the methods of oil recovery and CO2 storage using nonionic-based binary surfactant foams

Supervisors: Professor Alexey Cheremisin

Co-supervisor: Dr. Anastasia Ivanova

Name of the Reviewer: Chengdong Yuan

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	Date: 11-11-2024
--	-------------------------

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:

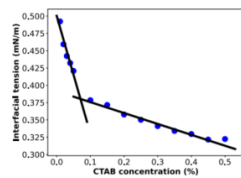
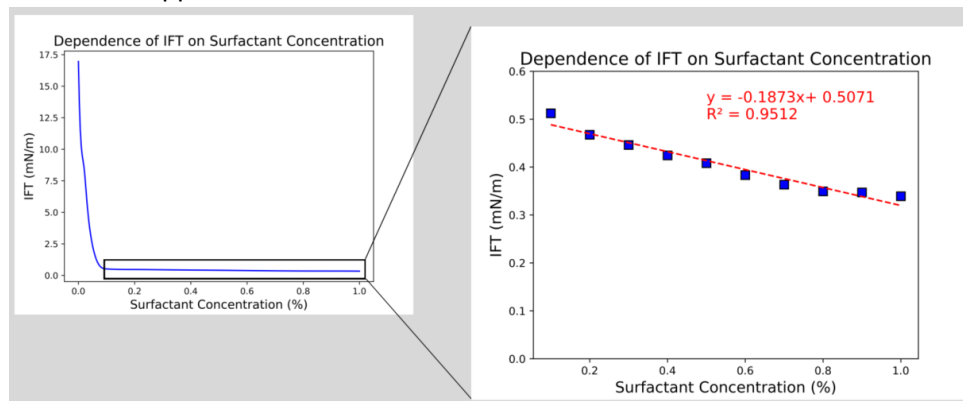
- Brief evaluation of the thesis quality and overall structure of the dissertation.
Generally, this is well organized work with clear structure.
- The relevance of the topic of dissertation work to its actual content
The topic is also related to the actual content.
- The relevance of the methods used in the dissertation
Not all methods are very suitable, some of them need more clarification to support the reasonability as I mentioned in the comments.
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
The results are complied with the international level, but some statements need to be revised to be more concise and careful.

- The relevance of the obtained results to applications (if applicable)
It can give some guidelines for field application of CO₂ injection.
- The quality of publications
The quality of publications is satisfied with Skoltech's requirements.

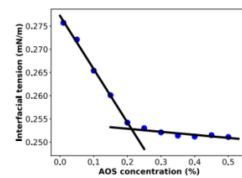
The summary of issues to be addressed before/during the thesis defense

The following issues need to be addressed before defense.

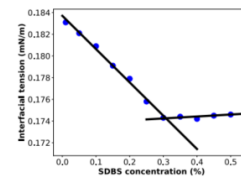
1. Please change "traditional commercial foaming agents". Binary surfactant is not something new as foaming agent. In China, many have been studied last 20 years.
2. Abbrevs are used in a messy way, for example, critical micelle concentration (CMC) and CMC are used at the same time in different places.
3. It was mentioned that the concentration after adsorption was determined by surfactant concentration post CMC. However, in most of time, there is no linear relationship between surfactant concentration and IFT, how the concentration can be accurately determined? The author previously also provide in Fig. 2.3 that in most of case, there is no linear relationship. Could you explain it. Or maybe there is some contradictory? Please check it carefully. Could the author provide calibration curve for each binary system to prove this, which can be useful. Or give more evidence that can support the method used here.



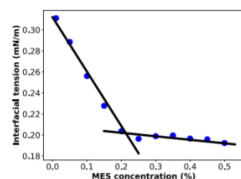
(a) CTAB



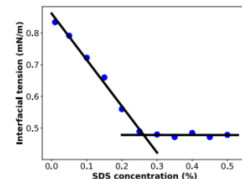
(b) AOS



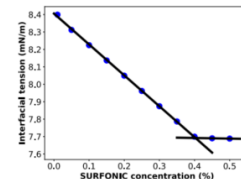
(c) SDBS



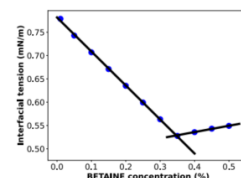
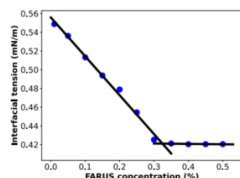
(d) MES



(e) SDS



(f) SURFONIC



4. For stability, the half-life time of foam is necessary, why are not they provided? Any explanation?

5. Could the author explain why the simulation work to match core flooding experiments was not performed to verify the validity of model before field scale simulation?
6. "foam can increase the CO₂ storage capacity by 2.6 times indicating the potential to store around 2 gigatons of CO₂ in the simulated model within a 100 year". Is it appropriate? How do you reflect foam properties in modeling after shut-in injection? Are they the same like for continuous injection?
7. In Scientific novelty: point 1, be careful use for the first time, because it is really not. This can cause problem when someone saw your thesis.

5.2. Fluid Properties	29
5.3. Experimental Setup	31
5.4. Unsteady State CO ₂ Injection	33
5.5. Steady State Co-Injection	34
5.6. Cleaning and Preparation Procedure	35
Part III. Results and Discussion	37
6. CO ₂ Foam Generation and Stability.....	39
6.1. The Effect of Foaming Agent on CO ₂ Foam Generation and Stability.....	39
7. CO ₂ Foam Generation and Coalescence.....	45

Point 2 also for the first time. Please check it carefully. Point 4 is really not new. This is very common method. You do not need to write a lot of points. Just find the real novelty from your work. 2-3 are good enough.

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