

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:

I confirm the absence of any conflict of interest

Date: 16-10-2024

Reviewer's Report

Ayomikun's thesis is an extensive study of non-ionic binary foams for enhanced oil recovery and CO₂ storage.

The thesis is very well written, it has a proper structure for scientific research. Figures and tables are of the high quality and do bring the essential information about the findings to a reader.

The topic of the dissertation is fully relevant to its content.

Ayomikun has published 4 papers in highly rated Q1 journals and these papers actually form the scope of the thesis. This ensures the highest research quality of Ayomikun's study. Moreover, Ayomikun has published 4 more papers in highly cited journals that are relevant to research, but not exactly match the overall scope. The latter confirms the high class of the candidate as a mature independent researcher. These 8 papers also confirm that the results are the state of the art at the international level.

Ayomikun uses up-to-date methods for surfactant characterization (tensiometry, conductimetry, viscosimetry in capillary tubes, foam stability tests, pendant drop, PT-stabilized core flooding etc.) as well as multiphase multicomponent reservoir modelling.

Research outcomes are fully relevant to their application to the high-priority directions in geoengineering, namely the enhanced oil recovery and CO₂ storage.

I have almost no concerns about the quality of this research. A few minor points to mention for possible correction/enhancement:

1. Upscaling to reservoir level is really good and straightforward. But I would include a discussion of the potential complications for the realistic cases, when the reservoir rocks and fluids are more heterogeneous in terms of mineralogy and fluid composition.
2. In terms of practical reservoir engineering for CO₂ storage, the outcomes look very promising. However, I would like to see the recommendation for field measurements/control units to physically monitor the actual field project like one modelled in the thesis. There are tons of factors in field geology, well construction and facilities that can influence and even fully spoil the real-life foam-assisted injection.

Overall, I have no doubts, that the research is of the very high quality and it definitely fits the PhD requirement. I do recommend awarding the PhD title to Ayomikun.

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