

Nancy, 12/04/2023

Review

of the Scientific Advisor for the dissertation thesis submitted on the Requirements for the Degree of Doctor of Philosophy (Ph.D.) in Petroleum Engineering (8D07202) Satbayev University by Durmagambetov Berik Oralovich titled “Hydraulic fracturing efficiency study and optimization of reservoir performance at the Arystan field”

This is to certify that the doctoral student, Mr. Durmagambetov, has successfully fulfilled all the requirements needed for the Ph.D. degree conferment. His thesis title is “Hydraulic fracturing efficiency study and optimization of reservoir performance at the Arystan field”.

The relevance of the work

Hydraulic fracturing (HF) is indeed one of the most effective methods for increasing well productivity in Arystan field, as well as in many other oil and gas fields around the world. However, as it was noted in dissertation, the effectiveness of HF depends on several reservoir conditions, including the Kh values, formation pressure, and thermobaric conditions that can trigger scale and corrosion issues. If these conditions are not favorable, the effectiveness of HF may be limited, and the flow rates of producing wells may decline despite repeated hydraulic fracturing. Mr. Durmagambetov provided an insight into these factors and their impact on well productivity decline, the dissertation can help to improve the efficiency and effectiveness of HF, leading to increased oil recovery and improved reservoir management. Furthermore, the practical applicability of the findings suggests that they can be readily applied in the field, making them valuable to both operators and researchers.

The research results, their scientific novelty, and practical value

The dissertation's focus on advanced methods of fracture analysis and sensitivity studies using an integrated approach demonstrates a research and scientific nature, which can help to advance the understanding and application of hydraulic fracturing techniques in the production stimulation industry in Kazakhstan and beyond. The integration of laboratory experiments, numerical modeling, and field measurements has enabled to

improve the understanding of hydraulic fracturing processes and optimize fracture design. The use of advanced fracture geometry analysis methods and fracture parameter sensitivity studies provided insights into the complex mechanisms involved in hydraulic fracturing, and helped to identify the key parameters that affect fracture growth and propagation.

The Ph.D. student has applied Lagrangian approach-based Multiphysics hydraulic fracturing modeling software that resulted in more accurate and realistic modeling of the hydraulic fracturing process, considering various physical and mechanical factors. As the result more precise and effective fracture designs has been provided, which resulted in well productivity increase and resource optimization.

In conclusion, the Ph.D. student has provided a high level of scientific research that is of high interest and contributes to the collective knowledge of the global community of petroleum engineers. Moreover, the work meets the requirements for the Ph.D. thesis. Therefore, I recommend that the author, Berik Durmagambetov, be allowed to defend his thesis because he deserves the Doctor of Philosophy (Ph.D.) in the specialty 8D07202 – Petroleum Engineering.

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