EXPERIMENTAL SET UP FOR INVESTIGATING PARTICLE BEHAVIOR AND FLOW DYNAMICS DURING CORE FLOODING

Rita **Njeru**[1], **Koroncz** Péter[2], **Szanyi** János[1]

[1] Szegedi Tudományegyetem Ásványtani, Geokémiai és Kőzettani Tanszék, Szeged

[2] Geochem Geological and Environmental Research, Consultancy and Service Ltd., 7673 Kővágószőlős, Hungary

e-mail: mwenderita@gmail.com

Clogging phenomena, observed in microchannels, streambeds, and filters, have significant implications for various applications. We present the preliminary findings of clogging experiments conducted in the GeoChem SmartLab. The study aimed to investigate the behavior of clogging particles and their impact on flow dynamics.

Samples used for this study were manufactured using fine grained sand. The porosity and permeability of the samples was first determined to ensure samples had the right petrophysical qualities. Three samples; MMDR132-4M, MMDR132-5M, and MMDR133-1M, were selected for further analysis.

The experimental setup involved critical flowrate tests to determine flow characteristics and subsequent clogging tests under various particle concentrations, flow rates, and pressure conditions following the methodology of Redekop et al., (2021). Effluent mass variation, pressure drop measurements, and examination of core samples have been used for analysis so far.

The critical flowrate tests indicated high flow rates for all samples. During the clogging test at a flow rate of 10 ml/min and 5% particle concentration, both samples MMDR133-1M and MMDR132-4M displayed a steady increase in pressure drop which indicate clogging occurrence. A closer physical examination of the clogged sample showed a filter cake and therefore the clogging can be as a result of filter cake formation. However, further investigations need to be carried to determine the presence and process of deep pore clogging. At a flowrate of 5 ml/min and 0.5% particle concentration sample MMDR132-5M exhibited very low and unsteady pressure drop fluctuations and particle deposition at specific sections of the feeding pipes, indicating an unstable flowrate and clogging process. This sample however did not form any filter cake.

These results emphasize the role of particle concentration and flowrate, in determining clogging behavior. Understanding these mechanisms and factors influencing particle deposition is crucial for optimizing the design and operation of microchannels.

The implications of these findings for various industrial applications are significant. Future research will focus on investigating the presence of deep pore clogging using microCT, particle-pore throat size ratios, particle concentration, and fluid flow conditions to further enhance our understanding of clogging behavior. Moreover, conducting additional experiments will allow a better understanding of how clogging occurs and progresses. We postulate that the clogging starts from the inlet side and the depth of clogging is directly proportional to the injected volume and the size of particles in the injected volume (Elrahmani et al., 2023).

In conclusion, the preliminary clogging experiments conducted shed light on the behavior of clogging particles and their impact on flow dynamics. The findings demonstrated the formation of filter cakes and particle deposition, confirming the occurrence of clogging. However, challenges were encountered in accurately analyzing the clogging process due to pressure drop fluctuations and leakage issues which were as a result of the flowrate not being high enough to transport the particle-laden water through the system. Future steps will include modifying the technical setup and conducting further experiments, with a different particle size to improve experimental accuracy. Overall, these findings contribute to our understanding of clogging phenomena and give incites on areas that need modifications. The practical application of this research is in geothermal tail water injection.

References

Elrahmani, A., Al-Raoush, R.I., Seers, T.D. (2023): Powder Technology **427**, 118736

Redekop, E., Boronin, S., Tolmacheva, K., Burukhin, A., Osiptsov, A., Belonogov, E. (2021): Journal of Petroleum Science and Engineering, **202**, 108504