Contribution ID: **672** Type: **Poster (+) Presentation**

A discrete element model (DEM) for swelling behavior of clay

Monday, 31 May 2021 19:35 (1 hour)

Swelling of Shale-rocks create several problems [1] during underground drilling operations, such as stuck-pipe/drill-bit. However, swelling of shale-rocks can close the gaps between rock (wellbore) and casing –therefore no cementing is needed –which can save a lot of time and money and such a "natural"closing ensures "no-leakage"during further drilling and production phases. The field experience reveals that some shale-rocks are good candidate for swelling and some are not. It is believed that, amount of clay is the most important factor for shale-swelling. There are several other parameters that can influence the swelling behavior, such as- porosity, quartz contents, clay-cluster distribution, stress difference between field and drilling zone etc. Therefore, to plan a safe and efficient drilling through shale-rocks, we should understand the swelling mechanism of clay.
To investigate swelling of clay, we have introduced a discrete element model (DEM), based on Monte-Carlo technique. We define a probability of swelling for all the clay grains in the shale-rock sample that includes the effect of stress-difference, porosity, temperature etc. The time evolution of grain swelling results in bulk swelling behavior of the sample and the simulation result qualitatively matches [2] with the observations of shale/clay swelling experiments [3,4]. The Monte-Carlo based DEM code has been studied [5] for the entire parameter space by varying several important inputs like porosity, clay-quartz contents, stress difference, temperature etc. In addition, the mass-transport phenomenon has been implemented by considering clay grain movement through fractures (flow channels).

Time Block Preference

Time Block B (14:00-17:00 CET)

References

1.E. Fjær, R. M. Holt, P. Horsrud, A. M. Raaen and R. Risnes, Petrolum Related Rock Mechanics (Elsevier, 2008).
2.S. Pradhan, Swelling behavior of shale/clay: Discrete element modeling, based on Monte-Carlo technique, Interpore 2019, Valencia, Spain.
3. M. Deriszadeh and R.C.K. Wong, Transp Porous Med (2014) 101:35–52 DOI 10.1007/s11242-013-0229-8.
4. E. Rybacki, J. Herrmann, R. Wirth and G. Dresen, Rock Mech Rock Eng (2017) 50:3121–3140.
5. M. A. Toresen, Master thesis on "Computational Modelling of Clay Swelling"2020-2021, Physics Department, NTNU, Trondheim.

Acceptance of Terms and Conditions

Click here to agree

Newsletter

Student Poster Award

Primary authors: Dr PRADHAN, Srutarshi (Researcher, PoreLab, NTNU); Mr TORESEN, Martin Alexander (Master Student, PoreLab, NTNU, Trondheim, Norway)

Presenter: Dr PRADHAN, Srutarshi (Researcher, PoreLab, NTNU)

Session Classification: Poster +

Track Classification: (MS4) Swelling and shrinking porous media