Contribution ID: **242** Type: **Poster (+) Presentation**

# Analytical modelling of foam in porous media

*Wednesday, 2 June 2021 09:00 (1 hour)*

It is reported that approximately only one-third of the original oil in place can be economically recovered from the reservoir after primary and secondary recovery (Osei-Bonsu et al., 2015, p. 520). Miscible gas flooding and steam gas injection, as effective enhanced oil recovery (EOR) techniques, suffer from poor sweep efficiency due to reservoir heterogeneity, gas fingering and gravity override (Farajzadeh et al., 2012, p. 11). Foam EOR has shown a great potential to improve oil recovery throughout the years. Strong foam may have an apparent viscosity that is much higher than that of the gas and liquid; therefore, increasing the gas volumetric sweep efficiency and reducing oil trapping (Shojaei et al., 2018b, p. 1073). Foam flow in porous media is exceedingly complex, which can be defined as a dispersion of gas in liquid separated by lamellae (Osei-Bonsu et al., 2015, p. 520). One of the major complications facing the foam EOR is how to accurately model the foam behaviour in porous media. The two widely used foam models, i.e., the local equilibrium (LE) model and the population balance (PB) model are either physically plausible or computationally expensive. Furthermore, the foam strength is largely dependent on foam texture, which is subsequently determined by water saturation, flow rate, surfactant concentration and pore geometry, etc. However, the influence of pore geometry is not considered in either the LE or PB model. The aim of this research is to propose a novel analytical foam model (AFM) that can predict the apparent viscosity of foam in porous media under complex boundary conditions. By employing the pore geometry data, a better understanding of various properties influencing the foam behavior will be achieved in the AFM model. The AFM model was then validated using existing published experimental data. Overall, we demonstrate a good match between the AFM model and the experimental data, under different foam quality, surfactant concentration and flow rate. The validated AFM model may be further integrated into the reservoir simulation softwares, as it provides a promising tool for reservoir engineers to capture the foam behavior in the reservoir during foam EOR process.

## Time Block Preference

Time Block A (09:00-12:00 CET)

## References

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2. Osei-Bonsu, K., Shokri, N., & Grassia, P. (2015). Foam stability in the presence and absence of hydrocarbons: From bubble- to bulk-scale. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 481, 514–526. https://doi.org/10.1016/j.colsurfa.2015.06.023
3. Farajzadeh, R., Andrianov, A., Krastev, R., Hirasaki, G. J., & Rossen, W. R. (2012). Foam–oil interaction in porous media: Implications for foam assisted enhanced oil recovery. Advances in Colloid and Interface Science, 183–184, 1–13. https://doi.org/10.1016/j.cis.2012.07.002

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**Session Classification:** Poster +

**Track Classification:** (MS6-B) Interfacial phenomena in multiphase systems