

2nd World Congress on

PETROLEUM AND REFINERY

June 01-03, 2017 Osaka, Japan

Non-equilibrium modeling of hydrates in porous medium**Bjørn Kvamme and Khadijeh Qorbani**
University of Bergen, Norway

In this paper, we focus on the geological storage of CO₂ in reservoirs with zones that are cold enough to facilitate CO₂ hydrate formation at local pressures. A 2D hydro-chemical mechanical model which has five layers (three layers with aquifers and two layers with cap rock in which we introduced two fractures) is created. We apply a reactive transport reservoir simulator, RetrasoCodeBright (RCB), in which hydrate is treated as a pseudo mineral. Following the recent modifications to account for hydrate dynamics in the code through a kinetic approach, we have further improved the simulator to implement the non-equilibrium thermodynamic calculations. In the present study, we spot the light on the hydrate formation effects on porosity in different regions, as well as on the flow pattern. These simulations are based on classical relationships between porosity and permeability, but the outline of ongoing modifications is presented as well. A critical question in such systems is whether hydrate formation can contribute to stabilizing the storage, given that hydrates are pore filling and cannot be stable toward mineral surfaces. The implications of hydrate formation on the geo-mechanical properties of the model reservoir are other aspects addressed in this study. This is an ongoing study with a constant development of adding new phase transitions involving hydrate into the simulator. Hydrate formation from aqueous solutions of hydrate formers is the most recent addition. Hydrate formation from primary or secondary adsorption on minerals is in progress. The overall goals is a hydrate simulator that can imitate real production scenarios (pressure reduction, temperature change, CO₂ injection) but also become a tool for estimating leakage fluxes of methane due to contact between hydrate and ground water under saturated with methane.

Biography

Bjørn Kvamme obtained his MSc in Chemical Engineering (1981) and PhD in Chemical Engineering (1984) from the Norwegian University of Technology and Natural Sciences. After a short period with SINTEF and two years at Bergen University College, he was appointed as full Professor in 1987 and started education of MSc and PhD in Process Technology in Telemark. He is appointed as a Professor in Gas Processing at the Department of Physics, University of Bergen in March 2000. He is the author/co-author of 422 publications during last 25 years, of which 148 are in good international scientific journals. He has 2270 citations as per May 1, 2017, and has presented numerous papers at international conferences.

bjorn.kvamme@uib.no

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