Project name: Salt Precipitation
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Summary

Production wells in gas reservoirs occasionally experience a significant performance decline as the gas production continues. The entrainment of formation water from gas reservoirs and the associated precipitation of dissolved salts in the late production stage can reduce the well productivity and may even result in total plugging of reservoir and tubing and ultimately result in losing the well. The salt precipitation, as well as the water wash treatments may lead to substantial production losses.
The goal of the project is to develop a simplified macroscopic model in order to predict the salt precipitation and the effect of water washes on the well performance. The model will be implemented in a software research tool.

To develop the understanding of the salt precipitation and dissolution phenomenon in gas wells the physics of those processes are investigated on a microscopic scale using CFD (Computational Fluid Dynamics) calculations ("Model A"). For a single pore the relevant physics were successfully implemented in a single and multi-phase (liquid and gas) CFD model. Moreover, single phase CFD calculations have been performed successfully on a representative multi pore geometry, however due to the extreme small time steps needed, the multi-phase multi-pore CFD calculations resulted in excessive and non- realistic calculation times.
On a more generic level a CFD model has been developed to compute the skin factor and pressure drop at the perforation layout of the well ("Model B").
Finally an actual macroscopic model ("Model C") has been implemented using the Dumu^{x} simulator developed by the University of Stuttgart. In this model the relevant mass balance equations for the three components (water, salt and methane) in the mobile phases of gas and liquid, and the solid phase of halite (precipitation and dissolution) have been incorporated. In the model, phenomena based on solubility, saturation, capillary pressure, (relative) permeability and porosity changes have been taken into account. Preliminary results confirm that the precipitation, and the dissolution by water washing can be simulated with Model C.

Experimental results from another TKI project (RVO reference: TEG0213004) will provide the capillary pressure, the relative permeabilities and the permeability-porosity relations to simulate the reservoir of interest. In a third TKI project (RVO reference: T2014-06-UG) the physics of the model will be further improved by letting the simulator internally adjust the capillary pressure to account for the changing properties
of porosity and permeability due to salt precipitation. Model B can be incorporated in Model C. Also in this third project the model will be used to perform a sensitivity study in order to determine the effect of a change in parameter values on precipitation and dissolution characteristics. In a later stage the model can also be used to study production optimization.