Using COMSOL Multiphysics® to Simulate Heat Exchanger Fouling By Heterogeneous Barite Crystallisation

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Abstract

Heat exchanger fouling is one of the biggest problems of industry. The induced loss of efficiency leads to oversizing and over-costs. In order to eliminate the fouling layer, maintenance operations are required.

This study focus on the physicochemical and hydrodynamic mechanisms involved in crystallisation fouling of geothermal heat exchangers. The description of the phenomenon relies on a multi-component transport model for the fluid. A heterogeneous crystallisation reaction describes the growth of the fouling layer on the pipe, induced notably by the temperature variations of the geothermal fluid, which impacts salt solubility.

Barite has been identified as one of the salts that might crystallise in those exchangers. The fluid is therefore considered as a ternary liquid composed of sulfate and barium ions diluted in water. The dynamic simulations of the model are made using COMSOL Multiphysics® and more particularly CFD and Heat Transfer modules, in the case of a cylindrical pipe. The results give us access to local values of the relevant model parameters along with the growth of the deposit along time. The impact of some numerical parameters on the results is investigated.