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Micro-Scale Simulation of Water Transport in Porous Media Coupled with Phase Change SAHAND ETEMAD, ARASH BEHRANG, PEYMAN MOHAMMADMORADI, HOSSEIN HEJAZI, APOSTOLOS KANTZAS, Chemical and Petroleum Engineering,University of Calgary,Calgary,CANADA — Sub-pore scale modeling of flow in porous media is gaining momentum. The concept of Digital Core Analysis deals with measurements of virtual core and the purpose of such modeling is to replace conventional and special core analysis when the latter are not feasible. Single phase flow phenomena are nowadays fairly easy to model given a good representation of the porous medium by its digital counterpart. Two phase flow modeling has proven more difficult to represent due to the complexities introduced by the insert of interfaces. These problems were at least partially overcome by the implementation of the "Volume of Fluid" method. OpenFOAM is the CFD package of choice in this work. The aforementioned approach is currently being extended in the modeling of phase change within a porous medium. Surface roughness is introduced by the incorporation of wedges of variable density and amplitude on the pore surface. A further introduced complication is that the individual grains are of different mineralogy and thus of different wettability. The problem of steam condensation in such media is addressed. It is observed that steam condenses first in the smallest of wedges, which act a nucleation sites. Water spreads on water-wet surfaces. Snap-off is observed in several cases leading to temporary trapping of vapor. Grid size effects are also addressed. The application of this modeling effort is the condensation of steam in thermal recovery methods.

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