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Numerical study of crude oil fouling in a Taylor-Couette-type reactor[1] MISHA CRASTES, LYDIA LAGKADITI, JONATHAN BALL, JUNFENG YANG, FRANCESCO COLETTI, SANDRO MACCHIETTO, OMAR MATAR, Imperial College London — We consider the non-isothermal flow of crude-oil mixtures in a Taylor-Couette-type reactor; this flow is accompanied by the deposition of soft-solid wall-layers, commonly referred to as "fouling, driven by chemical reactions and phase separation. Three-dimensional CFD simulations are carried out to resolve the flow and temperature fields, as well as the volume fraction of the foulant phase. The simulations also account for the effect of evolving deposit rheology. The CFD predictions are validated against published results for isothermal flow, in the absence of fouling, in terms of the characteristics of the vortical structures that accompany the flow. In the presence of fouling, we examine the spatial distribution of the wall stresses as a function of the Reynolds and Taylor numbers, and demonstrate that wall regions exposed to higher (lower) shear stresses tend to form thinner (thicker) fouling layers. The simulation results capture the trends observed experimentally.

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