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Viscoelastic Flow Modelling for Polymer Flooding SHAUVIK DE, JOHAN PADDING, FRANK PETERS, HANS KUIPERS, Eindhoven University of Technology, MULTI-SCALE MODELLING OF MULTI-PHASE FLOWS TEAM — Polymer liquids are used in the oil industry to improve the volumetric sweep and displacement efficiency of oil from a reservoir. Surprisingly, it is not only the viscosity but also the elasticity of the displacing fluid that determine the displacement efficiency. The main aim of our work is to obtain a fundamental understanding of the effect of fluid elasticity, by developing an advanced computer simulation methodology for the flow of non-Newtonian fluids through porous media. We simulate a 3D unsteady viscoelastic flow through a converging diverging geometry of realistic pore dimension using computational fluid dynamics (CFD).The primitive variables velocity, pressure and extra stresses are used in the formulation of models. The viscoelastic stress part is formulated using a FENE-P type of constitutive equation, which can predict both shear and elongational stress properties during this flow. A Direct Numerical Simulation (DNS) approach using Finite volume method (FVM) with staggered grid has been applied. A novel second order Immersed boundary method (IBM) has been incorporated to mimic porous media. The effect of rheological parameters on flow characteristics has also been studied. The simulations provide an insight into 3D flow asymmetry at higher Deborah numbers. Micro-Particle Image Velocimetry experiments are carried out to obtain further insights. These simulations present, for the first time, a detailed computational study of the effects of fluid elasticity on the imbibition of an oil phase.

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