148w Friction Theory and Free-Volume Theory Coupled with Statistical Associating Fluid Theory in Viscosity Modeling: Pure N-Alkanes

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Viscosity is one of the most important transport properties in reservoir simulation. Together with the thermodynamic properties of fluids, viscosity is used in flow simulation that predicts the movement of oil and gas flowing underground. Consequently, there is a need for accurate predictive models for viscosity calculations.

Viscosity models are usually empirical, thus the prediction ability is limited within the fitting conditions. However, there are some semi-theoretical approaches in use today, which have promising prediction ability. Two of them were very recently developed: the Friction Theory [1], which is based on friction concepts in classical mechanics and the Van der Waals theory of fluid, and the Free-volume Theory [2], which is based on the relation between free-volume fraction and the intermolecular energy controlling the potential field in which the molecular diffusion takes place.

Both viscosity models are tested to work with SAFT-like EOS. Due to the well-behaved EOS parameters, the parameters in the viscosity models are found to have simple correlation with molecular weight, particularly in the application of the models on a homolog series such as n-alkanes. The results of parameterization are presented, along with a demonstration of prediction ability. The characteristics of both viscosity models while working with SAFT EOS are also discussed.

References: 1. Quiñones-Cisneros, S. E.; Zéberg-Mikkelsen, C. K.; Stenby, E. H. The friction theory (f-theory) for viscosity modeling. Fluid Phase Equilib. 2000, 169, 249. 2. Allal, A.; Boned, C.; Baylaucq, A. Free-volume viscosity model for fluids in the dense and gaseous states. Phys. Rev. E 2001, 64, 011203.