

Black Art: Applying the PR EoS to Heavy Oil and Solvents

Harvey Yarranton, Chemical and Petroleum Engineering, University of Calgary

Phase behavior models are used in the simulation of several processes involving heavy oil and solvents including *in situ* recovery processes such as SA-SAGD (solvent assisted steam assisted gravity drainage) and surface processes such as solvent deasphalting. These models must represent the vapor-liquid equilibrium and liquid-liquid equilibrium behavior observed for the mixtures of bitumen and paraffinic solvents created in these processes. The Peng Robinson equation of state (PR EoS) is a commonly available tool in simulation packages. This presentation addresses the application of the PR EoS to mixtures of heavy oil and paraffinic solvents. The phase behavior of mixtures of bitumen and paraffinic solvents is reviewed. A methodology to characterize heavy oils for equation of state modeling and to apply the Peng Robinson equation of state (PR EoS) to mixtures of heavy oil and solvents is presented. The ability of the PR EoS to capture phase boundaries is demonstrated. The weakness of the PR EoS in modeling phase masses and composition in the liquid-liquid region is identified and possible remedies are discussed.

Biography

Harvey Yarranton is a Professor of Chemical and Petroleum Engineering at the University of Calgary. He received his B.Sc. (1985) and Ph.D. (1997) degrees in Chemical Engineering from the University of Alberta. Between degrees, he worked for Dome Petroleum Ltd. and Amoco Canada Ltd. in reservoir, production, and operations engineering. His research group has published over 130 journal papers in the areas of phase behavior and properties of heavy oils and solvents, the fundamentals and treatment of water-in-oil emulsions, and the fundamentals of solvent related heavy oil gravity drainage processes. He held the NSERC Industrial Research Chair in Heavy Oil Properties and Processing from 2010 to 2020. He is an Associate Editor for the SPE Journal, was a 2019/2020 SPE Distinguished Lecturer, and was awarded the SPE Regional Distinguished Achievement Award for Petroleum Engineering Faculty in 2021.