Application of an Improved Equation of State to Reservoir Fluids for Computation of the Minimum Miscibility Pressure

Kh. Nasrifar
Institute of Petroleum Engineering, Assistant Professor, University of Tehran, Tehran, Iran

M. Moshfeghian [C, S]
Department of Chemical Engineering, Professor, University of Qatar, Doha, Qatar

With increasing energy demand in the world, researches have been directed toward many methods to remove more oil from reservoirs. In Iran, miscible and immiscible oil displacements are the subject of current research in oil industry. Since there are huge and cheap gas resources, immiscible oil displacement is likely to be applied to many oil reservoirs; however, because of the lower oil recovery factor compared to miscible oil displacement, the latter seems to be also more cost effective. Calculating minimum miscibility pressure (MMP) is of practical consequence to petroleum engineers to adapt the method of miscible oil displacement. As a powerful tool, equations of state (EOS) can be used for this purpose. Usually, the constants of an EOS, for instance, the PR EOS, are tuned using the reservoir fluid PVT, then the EOS is applied to other calculations. However, an improved EOS is always demanding. This is the subject of this work. In this contribution, we introduce a modified EOS, namely, modified Nasrifar-Moshfeghian (MNM) EOS. The MNM EOS is a two-constant equation and needs three input properties to describe the PVT of pure fluids, i.e., critical temperature, critical pressure and acentric factor. The EOS parameters are correlated using the vapor pressure and saturated liquid density of a great number of hydrocarbons; i.e., from methane to tetracosane. However, the proposed EOS can also be applied to other normal fluids as well. Using van der Waals mixing rules, the EOS is extended to mixtures. This EOS has been applied successfully to hyperbaric reservoir fluid model systems, for instance, methane - n-tetracosane. Without any adjustment or correction, the retrograde behavior of a reservoir fluid has also been predicted accurately. Then, the minimum miscibility pressure is predicted using a simple method suggested for this purpose. The obtained results are promising and are in good agreements with experimental data.