Determination of Minimum Miscibility Pressure through Modeling and Simulation of Slim Tube Apparatus Performance

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Abstract

Miscible gas injection is one of the most effective enhanced oil recovery techniques and minimum miscibility pressure (MMP) is an important parameter in miscible gas injection processes. The accurate determination of this parameter is critical for an adequate design of injection equipment and thereby project investment prospects. The objective of the current paper is to develop a new universal artificial neural network model to predict the minimum miscibility pressure of CO_2 and hydrocarbon gas flooding. Different MMP correlations and models are proposed regarding the type of injection gas and the mechanism of miscibility respectively based on mathematical and thermodynamic calculations. Almost all of the correlations proposed in the literature either represent condensing/vaporizing mechanisms or give reasonable results only for the limited range of data they are based on. Experimental data from different crude oil reservoirs obtained through slim tube tests are gathered in order to develop a new model in which the mechanisms are included. Mixing rules are used to decrease independent variables. The significance of this model is that MMP can be determined for any composition of oil and gas no matter which mechanism is dominant in achieving miscibility. The comparison of the model results with the reliable data published shows that the results obtained from the new MMP model is more accurate and universal than most of the published models. Finally, a computer program for determining minimum miscibility pressure is presented.

Keywords: Minimum Miscibility Pressure (MMP), Miscible Gas Injection, Neural Network, Mixing Rules, Slim Tube