Improved Material Balance Equation (MBE) for Gas-Condensate Reservoirs Under Significant Water Vaporization

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Abstract

The phenomenon of retrograde condensation occurs when the reservoir pressure declines below dew-point pressure causing gas condensation and developing two-phase flow. Material Balance Equation (MBE) of gas condensate reservoirs is a real challenge because of the change in fluid composition and complexity of phase behavior.

Neglecting the effect of water vaporization may lead to inaccurate predictions of the material balance equation. Therefore, the main objective of this study is to develop an improved MBE model capable to describe gas condensate reservoirs under significant vaporization of connate water and water influx driving mechanism.

Two equations have been developed for gas condensate reservoir considering vaporization effect with and without consideration of water influx. Numerical examples have been developed and used to compare the accuracy of the newly-developed model with current models.

The results indicated that water vaporization has an important effect and should be considered for accurate MBE predictions. Error analysis showed that the new equation is more accurate than previously-developed models. The accuracy of the new MBE is attributed to the additional parameters introduced considering high pressure and high temperature conditions plus water influx effect.

The application of the new material balance equation will have important impact on predictions initial gas in place, reserve calculation and future simulation studies.

Key words: gas condensate, material balance, gas predictions, gas reserves.