

Miscible Gas Injection Studies: Rising Bubble Apparatus Test

APPLICATIONS

- Determination of minimum miscibility pressure (MMP) and minimum miscible composition (MMC)

BENEFITS

- Quick results
- Less expensive than conventional methods
- Less fluid required than for conventional methods

FEATURES

- Results are visible.
- Only a minimal sample is required.
- Bubble behavior is recorded on video.

Engineering of miscible gas injection projects requires a variety of laboratory studies to determine the phase behaviors of the injection solvent and reservoir fluid. Schlumberger provides a complete suite of miscible gas studies, one of which is the rising bubble apparatus (RBA) test.

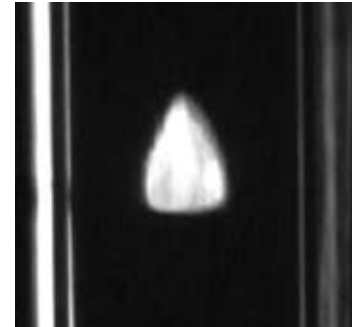
An RBA test is a fast way to estimate the MMP and MMC during a vaporizing gas drive injection study. The test involves direct visual observation of the behavior of a bubble of injection gas as it rises through a column of reservoir oil contained in the RBA cell. An RBA temperature-controlled air bath is equipped with front and back windows and a through-cell front light source that enhances the video-recorded image.

The glass tube is charged with reservoir oil to form an oil column and is then equilibrated at the desired test pressure (maximum: 69 MPa [10,000 psi]) and temperature (maximum: 200 degC [392 degF]). Gas injected into the oil column at the bottom of the tube forms a bubble. The behavior of this bubble (changes in its movement and shape) rising through the oil column over a range of pressures mimics the forward contact that occurs during the propagation of a gas slug through a reservoir. The compositional changes that occur with the transfer of components from the reservoir fluid into the injected fluid allow the MMP and MMC to be inferred from the bubble's behavior:

- Under miscible conditions, the bubble's condensation of components from the reservoir fluid will be reflected in its change in motion, shape, and disappearance before it reaches the top.
- Under immiscible conditions, only a limited compositional transfer occurs. The bubble will not change its motion or shape and will not disappear before it reaches the top.

Other miscible gas studies include swelling studies, multicontact tests, slim tube tests, and coreflood studies. Combined, the laboratory results from these studies define the miscibility conditions and the oil and solvent physical properties necessary to optimize recovery and production economics in gas injection processes.

BELOW MMP



ABOVE MMP



A gas bubble injected into a column of oil at the bottom of a tube rises to the top. Under miscible conditions, the bubble disappears before it reaches the top; under immiscible conditions, the bubble is visible throughout its flow.