

عنوان مقاله:

Characterization of Liquid Bridge in Gas/Oil Gravity Drainage in Fractured Reservoirs

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خلاصه مقاله:

Gravity drainage is the main mechanism which controls the oil recovery from fractured reservoirs in both gas-cap drive and gas injection processes. The liquid bridge formed between two adjacent matrix blocks is responsible for capillary continuity phenomenon. The accurate determination of gas-liquid interface profile of liquid bridge is crucial to predict fracture capillary pressure precisely. The liquid bridge interface profile in the absence and in the presence of gravity is numerically derived, and the obtained results are compared with the measured experimental data. It is shown that in the presence of gravity, fracture capillary pressure varies across the fracture, whereas, by ignoring gravitational effects, a constant capillary pressure is obtained for the whole fracture. Critical fracture aperture which is the maximum aperture that could retain a liquid bridge was computed for a range of liquid bridge volumes and contact angles. Then, non-linear regression was conducted on the obtained dataset to find an empirical relation for the prediction of critical fracture aperture as a function of liquid bridge volume and contact angle. The computation of fracture capillary pressure at different liquid bridge volumes, fracture apertures, and contact angles demonstrates that if the liquid bridge volume is sufficiently small (say less than 0.5 microliters), capillary pressure in a horizontal fracture may reach values more than 0.1 psi, which is comparable to capillary pressure in the matrix blocks. The obtained results reveal that the variation of fracture capillary pressure versus bridge volume (which represents liquid saturation in fracture) obeys a trend similar to the case of matrix capillary pressure. Therefore, the capillary pressure of matrix can be applied directly to fractures considering proper modifications. The results of this study emphasize the importance of capillary continuity created by liquid bridges in the performance of gas-oil gravity drainage in fractured reservoirs.

کلمات کلیدی:

Fractured Reservoir, Gravity Drainage, Capillary Continuity, liquid bridge, Fracture Capillary Pressure

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