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Analytically evaluate relative permeability at unsteady-state core flooding

Hisham Khaled Ben Mahmud[1] and **Walid Mohamed Mahmud**[2]
[1]Curtin University, Malaysia
[2]University of Tripoli, Libya

Simulation of multiphase flow in porous media requires knowledge of relative permeability, which is one of the essential measurements in reservoir engineering due to the common existence of two-phase flow in the reservoir. The precise test of relative permeability can be performed either by steady-state or unsteady-state flow method. The aim of coring and core analysis is to reduce uncertainty during reservoir evaluation via providing reservoir data *in situ* conditions. The advances in core flooding and core analysis techniques provide the premise to obtain essential petrophysical properties and to simultaneously find other reservoir rock dependent parameters. Thus, the aim of this work is to develop a model is utilizing Sendra software (Ref) for unsteady-state displacement method validated by two-phase flow experimental measurements. This model is based on a novel generalization of the classical Buckley-Leverett fractional flow theory for constant pressure boundary conditions. It includes the effect of fluids viscosities and the average fluid saturation at the breakthrough moment as measured by the rapid displacement method. Under constant pressure boundaries, relative permeability and fluid saturation were determined from unsteady-state measurements using Johnson, Bossler and Naumann (JBN), Pirson's correlations and Sandra simulation software. Based on analytical results, the most accurate relative permeability measurements were made on a native-state core, where the reservoir wettability was preserved. Moreover, Sendra software and JBN methods yielded close non-wetting phase relative permeabilities of an oil-wet sample while Pirson method yielded somewhat significant difference. Water-wet core samples were characterized by limited oil production after water breakthrough but generally yielded good recoveries and low water relative permeabilities at residual oil saturation.

hisham@curtin.edu.my

Gas plant troubleshoot hydrate problem with out of box solution

K Sabapathi and Saleh Al Jatley
KNPC, Kuwait

The train-4 gas plant is designed to process 0.9 Bcfd of Kuwait associated gases to produce methane, ethane, propane, butane and naphtha using GSP process. Column is flooding frequently and could not reach the desired recovery and purity. The potential causes like, leak in the re-boiler, feed by pass to column, tray design and damage were analyzed. Mole sieve driers were also evaluated. Feed quality and potential freeze of heavy component were analyzed and concluded that there is no problem in this regard. Product gas quality measured with multiple analyzer and moisture <0.050 ppmV, but flooding continued. Methanol injection helped improve the situation. Mercury guard bed outlet moisture is around 3 to 5 ppm. Hg guard bed inlet contains 1000 ppmV H_2S and 1 mol% CO_2 (H_2S-CO_2→COS+H_2O). COS can be formed in molecular sieve dehydration beds downstream due to absence of water. Hg bed alumina aids the formation of COS due to large surface area available for catalysis and basicity of the crystal structure in the alumina part of the adsorbent. Rate constant of this equation is function of temperature, when the temperature is higher during switching bed and the water peaks measured in the same time after bypassing the mercury guard water content to zero. Therefore, it was decided to shift the mercury guard bed in the upstream of the drier bed. This will call for shutdown of the plant, as interim measure it was decided to fill the vessel with sulfur impregnated carbon on temporary basis.

k.sabapathi@knpc.com