

Rapid Measurement of PVT in Heavy Oil System - A Challenge

Raj S.V. Rajan ^{C, S} and Gerard Korpany
Alberta Research Council, Edmonton, AB, Canada

There is need for quantitative data on the Vapour Liquid Equilibrium (VLE) properties of heavy oil/bitumen-gas systems including the density of the solute gas/oil mixture, and the swelling factor of the gas-saturated oil at the reservoir/process conditions for reservoir engineering calculations for the development of oil recovery processes. The existing methods of PVT measurement are not suitable for rapid measurements being very slow and not cost effective. The objective of this project was to develop a new method to facilitate rapid and accurate PVT measurement in heavy oil/bitumen-gas systems in a cost effective manner. Based on a number of PVT measurement techniques reviewed, gravimetric measurement based ones were preferred. Diffusion analysis calculations indicated that in a typical case of common solute gases in contact with a heavy petroleum hydrocarbon, the oil amount (thickness of a sessile drop on a substrate) would be about 250 microns or less ($< \text{about } 15\mu\text{L}$) in order to keep the time for complete saturation less than about an hour in comparison to the time of the order of many more hours in the conventional PVT measurements. Two commercial technologies - a quartz crystal microbalance (QCM) and a magnetic suspension balance (MSB) were reviewed. The MSB is a conventional and expensive gravimetric instrument while the QCM is a much less expensive piezoelectric device which measures the resonant frequency change of a quartz crystal as a function of mass. Laboratory test results using the QCM200 system with liquids of varying viscosities to determine the feasibility of its use as the mass measurement device for rapid PVT measurement with heavy oil/bitumen system are discussed.