doi:10.20396/revpibic.v0i0.id

XXVI Congresso de Iniciação Científica Unicamp
17 a 19 de outubro Campinas | Brasil

Experimental measurement of the specific mass of drilling fluids at high pressure and high temperature

Vinicius H. Boschini*, Nara A. Policarpo, Nilo R. Kim, Paulo R. Ribeiro

Abstract
The knowledge of specific mass of drilling fluids are of great importance in defining the characteristics of them during drilling wells. In the present work, the specific mass of distilled water was carried out in a PVT (Pressure-Volume-Temperature) cell using the Constant Composition Expansion procedure under high pressure and high temperature. Results showed a good agreement with literature values.

Key words:
Drilling Fluids, Specific Mass, Water.

Introduction

Concerning drilling wells, it is very important for the safety throughout the operation to prevent the occurrence of kicks or more dangerous situations, such as blowout. Drilling fluids are the key to ensure the safety of drilling oil wells because it must exert hydrostatic pressure over the reservoir during drilling[1]. Therefore, it is important to know their properties and their interaction with the gases found in the petroleum reservoirs. One of the main property that it should be known is the specific mass of the drilling fluid, which can be measured through a PVT (Pressure-Volume-Temperature) cell[2]. In the present work, experimental tests were performed to determine the specific mass of water under pressure and temperature conditions found at petroleum reservoirs.

Results and Discussion

The specific mass tests of the distilled water were conducted in a PVT cell (Schlumberger) by the Constant Composition Expansion (CCE) procedure[2]. This procedure consists of the expansion of a fluid under constant temperature, either pure or mixture, through the application of constant pressure gradients. During the test, the pressure, volume and temperature of the fluid are recorded. Tests were run in triplicate using 30 g of distilled water at temperatures of 30, 50 and 80ºC and pressure range of 0 to 8000 psig. At each pressure gradient of 1000 psig under constant temperature, the volume of the fluid was recorded. With the data of mass (m) and volume (V) of water, the values of specific mass (ρ) of the water as a function of the pressure and temperature were calculated according to Equation 1. Image 1 shows the specific mass values of the distilled water obtained experimentally and the values obtained in the literature[3]. The experimental values are the mean values of specific mass obtained from the triplicates at each temperature. Experimental values of specific mass are quite accurate since they are very similar to the values found in the literature, showing errors below 1% for the pressure and temperature range studied.

$$\rho = m/V \quad (1)$$

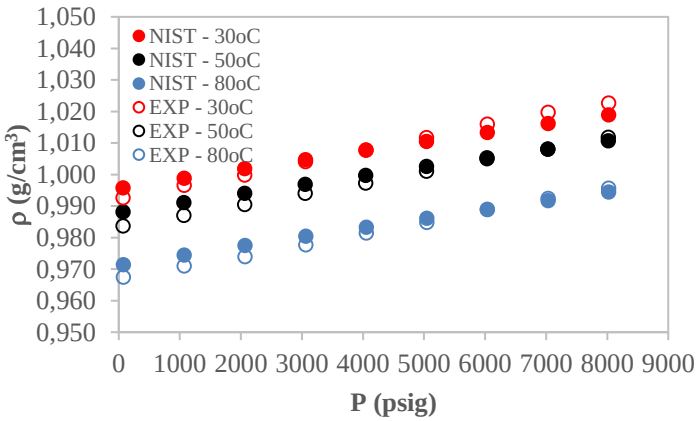

Image 1. Specific mass of distilled water – experimental and literature values[3].

As the experimental results matched properly the literature values, it can be stated that PVT cell is able to run tests for other drilling fluids, such as olefins and glycerin.

Conclusions

The specific mass of water at high pressure and high temperature were accurately found through a PVT cell. Hence, the PVT cell is capable to run tests for measurements of thermodynamic properties of the other drilling fluids, such as olefin and glycerin.

Acknowledgement

The authors are thankful for Petrobras financial support.

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