

Experimental Study to Measure Salinity and Water fraction in oil in water emulsions (O/W) using impedance sensors

Guilherme Malavasi (IC)

Abstract

In this paper the term under study will be the volume fraction of water in O/W (oil in water) emulsions, and the study was later extended to the purpose of better understanding of the phenomena involved, analysis of saline water samples and Air itself. This quantity will be initially studied in static tests in two test vats, but can be extended to flows.

Impedance, salinity, Oil

Introduction

This work aims to evaluate whether the measure impedance has relationship with the volume fraction of water and the concentration of sodium chloride (NaCl) in O/W emulsions, especially evaluating its correlations and trying to identify them and distinguish them. As well as the identification and characterization of double-layer effects observed experimentally, principally at low frequencies, tests with deionized water, trying to explain the correlation between the variation of the study frequency with the variation of water dielectric constant. This study is essential to assess the feasibility of using impedance sensors to measure the volume fraction of water in O/W emulsions (oil in water). In these experiments the independent variables studied were the volumetric ratio between the continuous and dispersed phase respectively water and oil, together with the dissociated salt concentration in the sample that are the variables of interest for the development of the instrument

Results and Discussion

Tests were carried out making conductance measurements of oil in water O/W emulsions, water and saturated NaCl solutions dissolved, and deionized water in vats of two rectangular parallel plates. Another battery of tests was carried out with water and NaCl solutions at different concentrations, ranging contact paper layers on the conductors of the vat in order to check the influence of the insulation on the conductance and susceptance of the sample. Were also made trials with deionized water, the tests aimed to the analysis of dielectric constant varying the deionized water depending on the measuring frequency. In initial tests we have noticed the change in conductance directly linked to the variation of α oil fraction as well as big influence of the sample water salinity. Both variants have the same analytical purpose, that is, produce equivalent changes in admittance measurement solution. The deposition on the electrodes,

represented by the addition of contact paper, caused a higher resistance making the sample conductivity measure smaller. For tests with deionized water, we noticed a dielectric constant variation of the water as a function of measurement frequency, where for very low frequencies, noted that the double layer effect (Helmholtz), where for larger frequency ranges, a behavior like the Debye model was observed.

Conclusions

Several analyzes were made from the experiments, we note the large presence of the influence of the concentration of sodium chloride (NaCl) and the volume fraction (α) of oil and water, therefore necessary to know the fraction α , knowing the salinity of the solution. We noted the analysis of experiments conducted with air as dielectric, the great influence of parasitic impedances of measurement device and may cause small experimental errors.

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¹ **Karcher, Viviane.** *Determinação da Energia Interfacial de Emulsões de Água em Óleo Pesado.* Campinas - SP : UNICAMP- Dissertação de Mestrado, 2008.