Electromagnetic Characterization And Simulation Of Mexican Heavy Oil Altamira.

A. Vazquez Vazquez[1], Z. Chen[2]

[1]Universidad Politecnica de Altamira, Altamira, Tamaulipas, Mexico
[2]University of Calgary, Calgary, Alberta, Canada

Abstract

Electromagnetic characterization plays an important role in both simulation and microwave heating applications. Particularly in the recovery of Mexican heavy oil, it is essential to perform electromagnetic characterization in order to understand more about the behavior of Mexican heavy oil Altamira being heated by electromagnetic fields.

Through an experimental equipment consisting of: a gunn oscillator that generates an output frequency of 10,525 Ghz with a output power of 10 mW, a slide-screw tuner and a crystal detector, a 690 mm3 sample of Mexican heavy oil Altamira was taken and placed at the bottom of a commercial waveguide of the FESTO brand to perform electromagnetic characterization, and then simulation is carried out for the electromagnetic characterization of the same sample to validate the data obtained in the experiment. The COMSOL Multiphysics® simulator is used; specifically the Heat Transfer, RF and Matter Library modules were used.

The results obtained by electromagnetic characterization from the experimental study of the Mexican heavy oil Altamira show a dielectric constant of $\varepsilon r = 10.71\text{-}j70.02$; on the other hand, the results obtained from the simulation of the Mexican heavy oil Altamira show a constant dielectric of $\varepsilon r = 10.93\text{-}j70.85$. With this study, we can show that both the results obtained from the experiment and the results from the simulation are very similar, validating the results obtained by both approaches. Therefore, we provide indispensable tools being capable of characterizing samples of heavy oil not only from Mexican heavy oil Altamira but also from anywhere in the world.

Through the electromagnetic characterization of the Mexican heavy oil Altamira, an accurate measurement of the dielectric constant can be performed. Because of this, it will be possible to have a better understanding of the behavior of the Mexican heavy oil Altamira with electromagnetic fields when it is heated and recovered with this innovative technique.

Figures used in the abstract

Figure 1 : Figure 1.- Equipment for dielectric characterization by the Von Hippel method

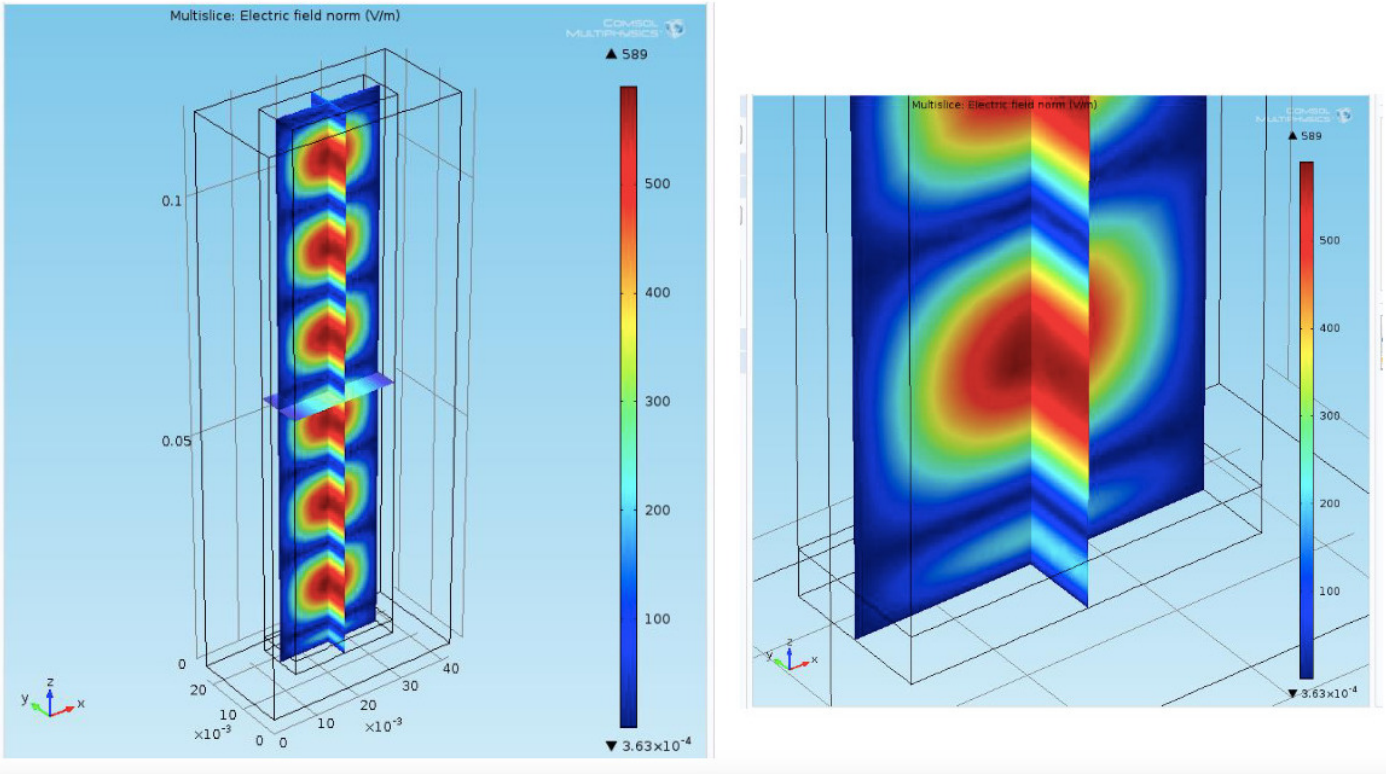

Figure 2 : Figure 2: Simulation of the dielectric characterization by the Von Hippel method.