Electrical resistivity in saturated synthetic porous media #717

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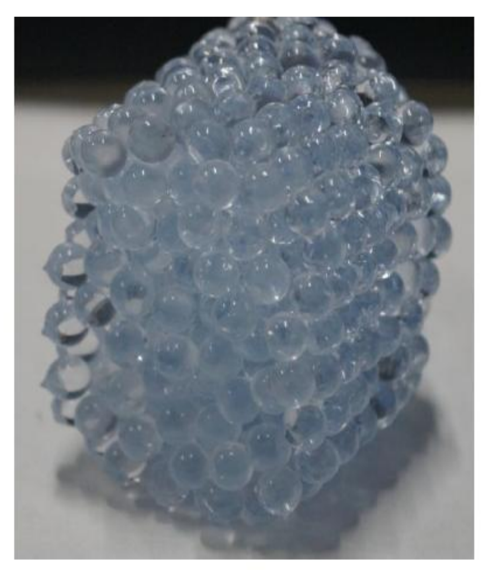
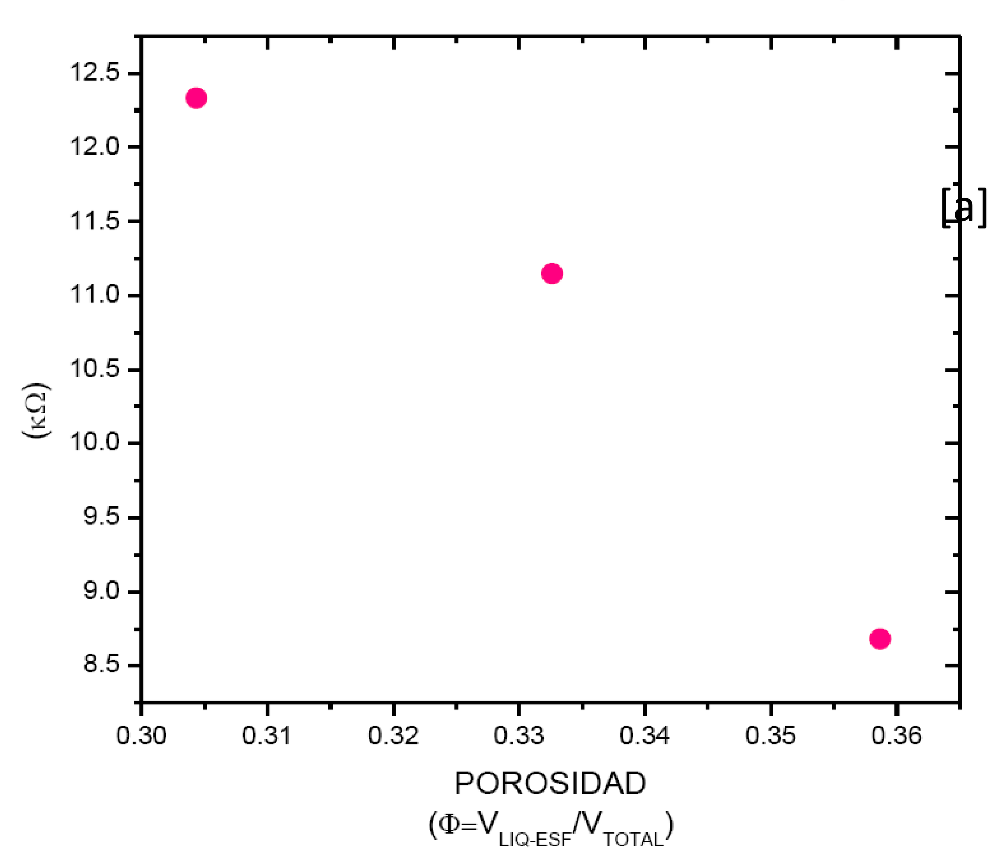
Abstract

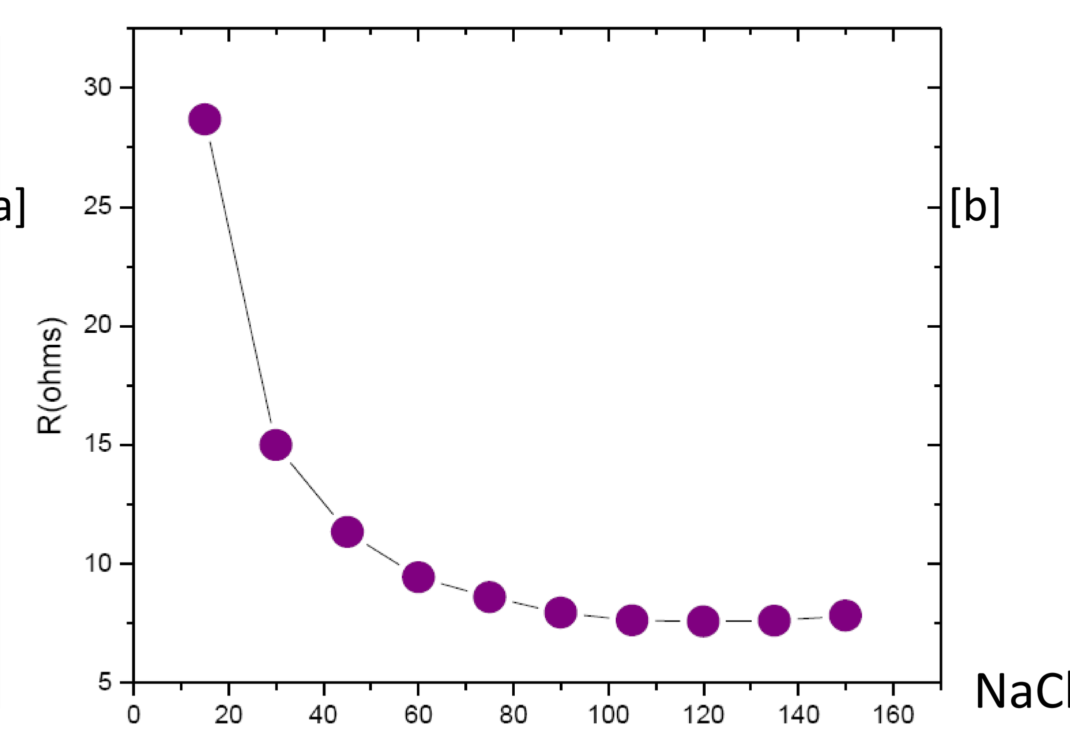
Experimental measurements of electrical resistivity of synthetic rocks with confining pressures up to 1700 bars and 200°C were performed in a high pressure cell to evaluate how the correlation between size pore distribution and brine composition is [1]. The porous media were manufactured with homogeneous glass beads and were saturated with different salt concentrations brines. According to our results the electrical resistivity decrease in synthetic rocks with high porosity [2]. In this talk we explain in what conditions this electrochemical effect produce a decay in the resistivity and how is related to porous media. Our results indicate that the fluid phase is the principal responsible of the electrical resistivity. To prove this result we test on dry synthetic porous media and we compare how the wettability modifications on the solid phase modify the behavior when the rock is saturated. The aim of this work is to describe the electrical resistivity under reservoir conditions in synthetic porous media saturated with brine [3]. Our results can be useful to predict the behavior in some real rocks



Synthetic porous media [2]

Porous media were built with glass beads under different temperature ramps. The porosity is controlled by the size of the beads. The synthetic porous media can reproduce the different lithologies and helps to simulate wide ground subsoils.





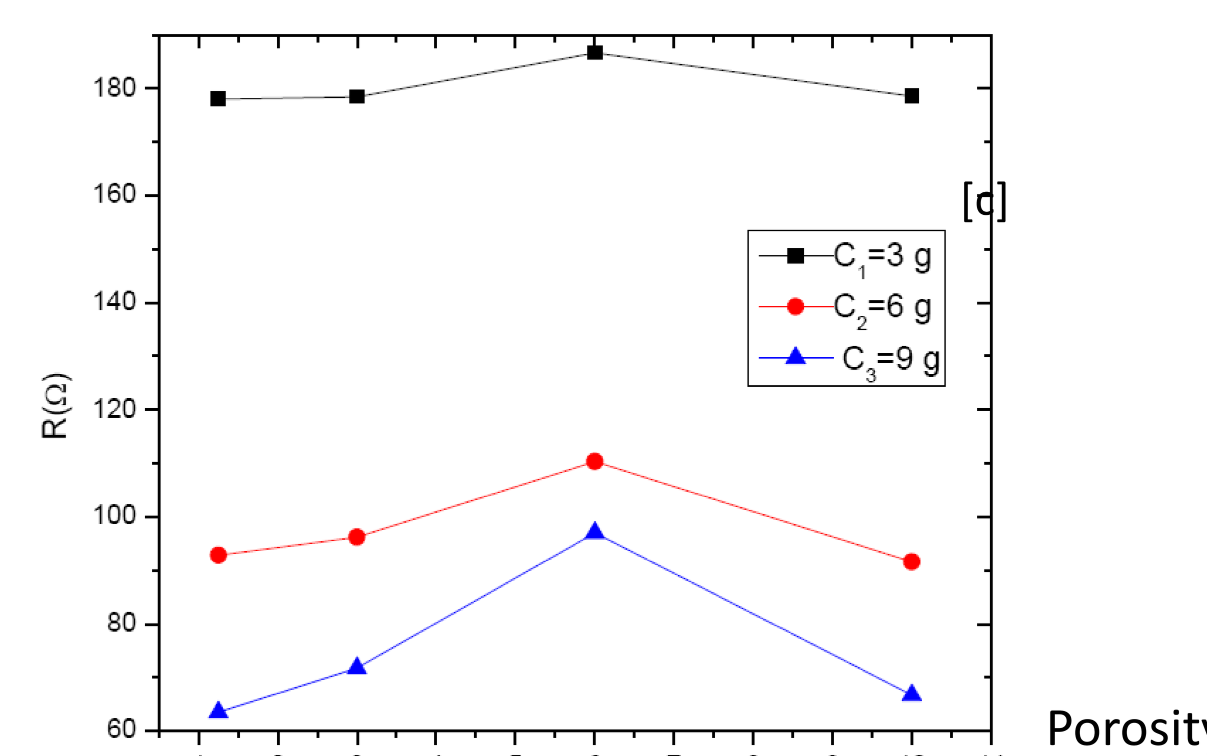
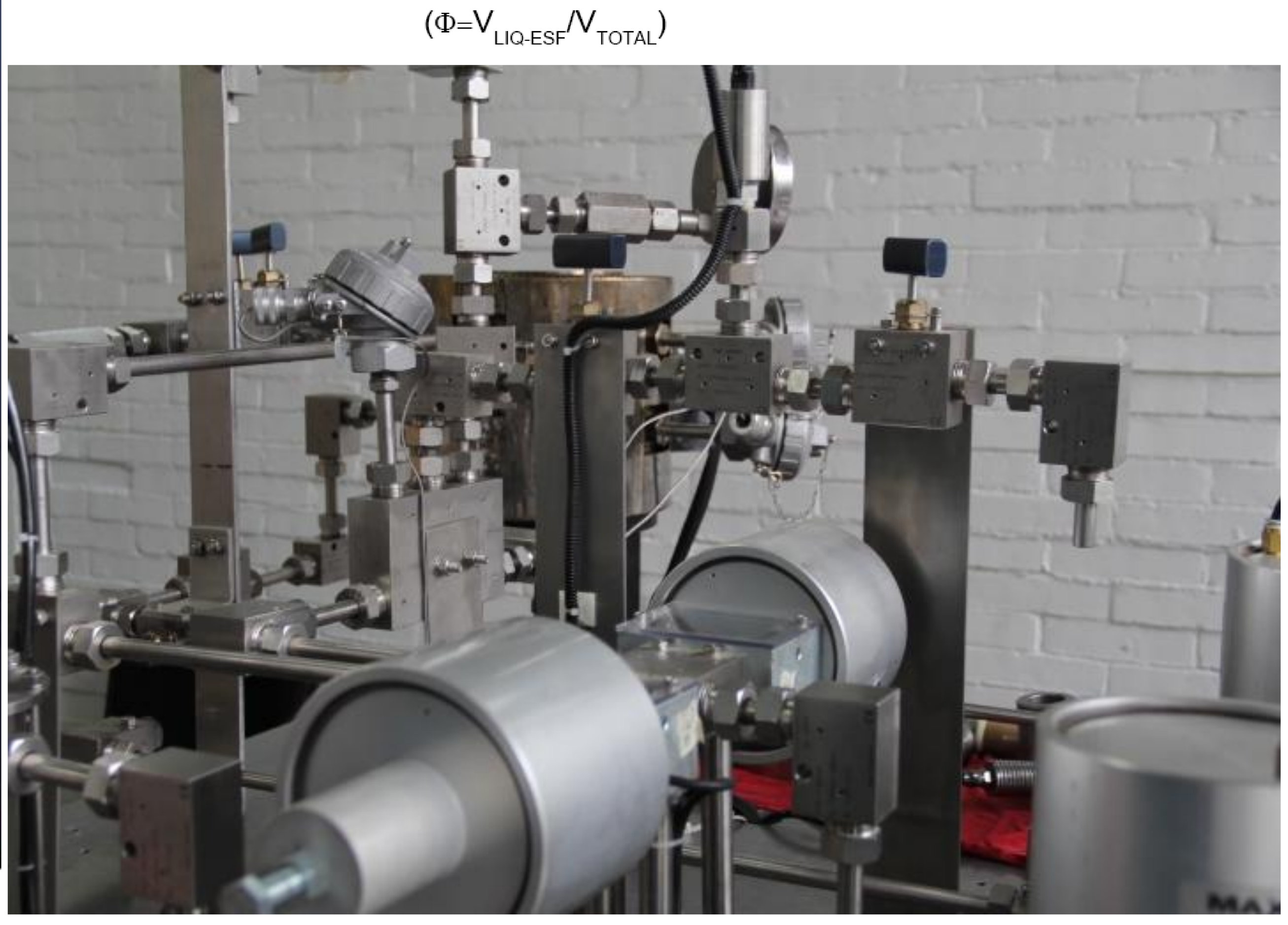


Figure (a) describes the behavior of Resistivity as a function of porosity for three different synthetic porous media. Figure (b) shows the resistivity as a function of NaCl concentration and Figure (c) presents the resistivity as a function of porosity for three different concentrations of NaCl. All the experiments were performed in normal conditions of pressure and temperature.



Resistivity, Permeability and Porosity

The electrical behavior on crude reservoirs or geothermal reservoirs depends on the porosity and permeability of the rocks. We are interested in evaluate the resistivity as a function of the porosity.

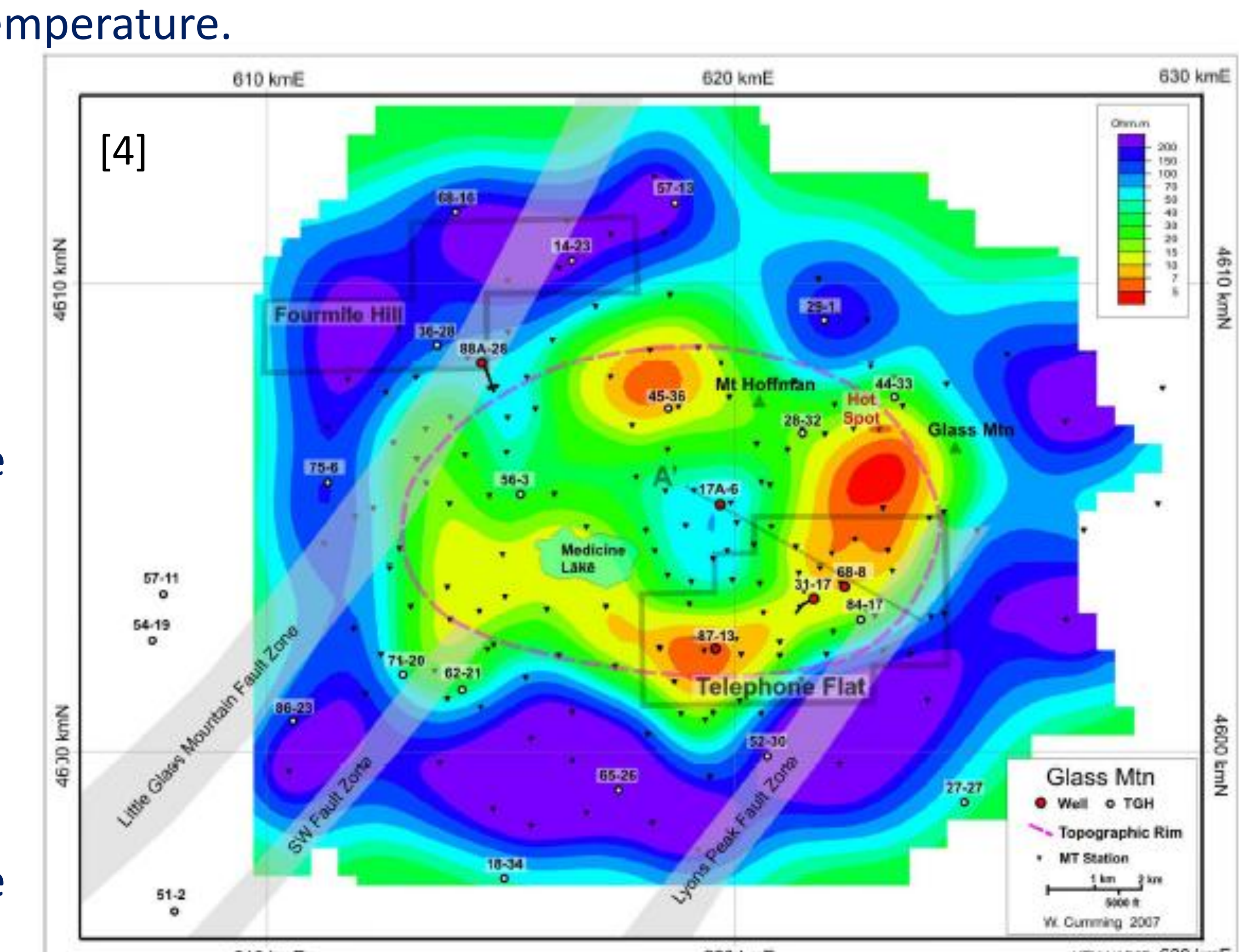


Figure 2. Glass Mountain 3D MT resistivity at 1700 m elevation.

By controlling the porous media and the injection of different NaCl solutions we are interested in describe and predict the crude localization or different energy fonts. The high pressure chamber allow to simulate reservoir conditions in laboratory up to 25KPSI and 200°C. We compare our synthetic porous media with real rocks and we found that the resistivity is affected directly by the porosity. These preliminary results give us the next step to prove the experimental methodology varing NaCl.

Conclusions and Future work

The methodology to manufacture synthetic porous media allow us to reproduce a wide varitety of rocks. We obtain the behavior of resistivity as a function of different NaCl concentrations and for different porous media. The next step is to submitt the synthetic porous media to reservoir conditions to evaluate the effect on resistivity.

References:

[1]Dante Hernandez-Diaz, Oscar Chavez, Alberto Beltran, Armando Garcia, Baltasar Mena, and R. Zenit, Experimental study of the effect of wettability on the relative permeability for air-water flow through porous media (Submitted 2017)

[2] Elsa de la Calleja, Roberto Zenit. Permeability in porous media under reservoir conditions (To be submitted)

[3] Ignacio Aguilar, Elsa de la Calleja, Roberto Zenit. Resistivity in porous media under reservoir conditions (To be submitted)

[4] Cumming, W. Mackie, R. 3D MT Resistivity Imaging for Geothermal Resource Assessment and Environmental Mitigation at the Glass Mountain KGRA, California. GRC Transactions, 31 (2007)