

**A new model for the spectral induced polarization signature  
of bacterial growth in porous media**

A. Revil<sup>(1),(2)</sup>

(1) *Colorado School of Mines, Golden, CO. USA*

(2) *CNRS, ISTERRE, Grenoble, France*

The complex conductivity of porous materials and colloidal suspensions comprises two components: the in-phase conductivity associated with electromigration of the charge carriers and the quadrature conductivity associated with the reversible storage of the charges at some polarization length scales. We have developed a new quantitative model to investigate frequency-domain induced polarization response of suspensions of bacteria and bacteria growth in porous media. Low-frequency induced polarization of bacteria (alpha-polarization) is related to the properties of the electrical double layer of bacteria. Surface conductivity and alpha-polarization are due to the Stern layer of counterions occurring in a brush of polymers coating the surface of the bacteria and can be related to their cation exchange capacity of the bacteria. This new model can be coupled to reactive transport modelling codes in which the evolution of bacterial populations are usually described by Monod coupled kinetics. We have shown that the growth rate and endogenous decay coefficients of bacteria in a porous sand can be inferred from time lapse frequency-domain induced polarization data.