



HAL
open science

Spectral induced polarization of nanoporous media

Philippe Leroy, Andreas Hördt, Matthias Bücker, Egon Zimmermann, Johan Alexander Huisman

► **To cite this version:**

Philippe Leroy, Andreas Hördt, Matthias Bücker, Egon Zimmermann, Johan Alexander Huisman. Spectral induced polarization of nanoporous media. 5th International Workshop on Induced Polarization, Oct 2018, New York, United States. hal-01875288

HAL Id: hal-01875288

<https://brgm.hal.science/hal-01875288>

Submitted on 17 Sep 2018

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

5th International Workshop on Induced Polarization
Rutgers University, Newark

Spectral induced polarization of nanoporous media

Philippe Leroy¹, Andreas Hördt², Matthias Bücker³, Egon Zimmermann⁴, Johan Alexander Huisman⁵

¹*French Geological Survey, Water Department, Orléans, France, p.leroy@brgm.fr.*

²*Braunschweig Technical University, Institute for Geophysics, Braunschweig, Germany, a.hoerd@tu-bs.de.*

³*Wien Technical University, Geoinformation Department, 1040 Vienna, Austria, buecker.matthias@yahoo.de.*

⁴*Forschungszentrum, Electronic Systems ZEA 2, Jülich, Germany, e.zimmermann@fz-juelich.de.*

⁵*Forschungszentrum, Agrosphere institute IBG 3, Jülich, Germany, s.huisman@fz-juelich.de.*

Nanoporous materials such as clays and concretes are relevant for the storage of oil, geothermal energy, CO₂, and nuclear waste in deep geological formations because of their high specific surface area and resulting low permeability that confer them remarkable confining properties. Their mineralogical nature and petrophysical properties can be in-situ identified and quantified using non-invasive geoelectrical methods such as spectral induced polarization (SIP). Despite their observed high chargeability, the SIP response of these nanoporous materials should also be better understood. In this work, SIP laboratory measurements on montmorillonite suspensions and concrete, and their interpretation using grain or pore (membrane) polarization models, are presented. We show that it is possible to explain their SIP response using the electrochemical properties of the double layer at the mineral surface and the Poisson-Nernst-Planck equation, to get the surface electrical and petrophysical properties such as grain or pore size distribution. Nevertheless, more work should still be done to better describe the pore-scale SIP response and a more general and upscaling approach is necessary to use mechanistic models to better interpret field-scale SIP measurements.