Geophysical Research Abstracts,
Vol. 10, EGU2008-A-10512, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-10512
EGU General Assembly 2008

Transport of water in a weakly-hydrated model clay soil

L. Ramstad Alme(1), **J. O. Fossum**(1), Y. Méheust(2)

(1) Department of Physics, Norwegian University of Science and Technology (NTNU), Trondheim, Norway, (2) Université Rennes 1, Geosciences Rennes, UMR CNRS 6118, Rennes, France

We address the transport of water through a model soil consisting of a loosely-aggregated powder of swelling clay (smectite) nano-layered particles. Water has the ability to intercalate stepwise into the nano-porous layered structure of such smectite particles (hence, the term water layers[1]). This makes water transport through the inter-particle clay powder mesoporosity a complex phenomenon, since (i) part of the humidity is trapped in the surrounding particles, and (ii) the particles swell as a result of water intercalation, which leads to a change in the geometry of the mesopores. By imposing a humidity gradient along clay powder samples contained in cylinders and kept at fixed temperature, we have studied quasi-one dimensional water transport in such systems[2,3]. X-ray scattering from the nano-stacks, resolved both in time and in space, provides information on the spatial ingress of the humidity front in the meso-pores, as well as on the amounts of water intercalated in the particle nano-pores. The two interlinked fronts, i.e., humidity (in meso-pores) and intercalation (in nano-pores), have been analyzed together in terms of the classic diffusion scaling variable $x/t^{\gamma/2}$. The result of this analysis suggests near normal diffusive behavior, i.e., an anomalous diffusion exponent γ close to 1 [4].

[1] G.J. da Silva, J.O. Fossum, E. DiMasi, K.J. Måløy, S.B. Lutnæs, *Phys. Rev. E* **66**, 011303 (2002) – G.J. da Silva, J.O. Fossum, E. DiMasi, K.J. Måløy, *Phys. Rev. B* **67**, 094114 (2003)
[2] G. Løvoll, B. Sandnes, Y. Méheust, K.J. Måløy, J.O. Fossum, G.J. da Silva, M.S.P.

Mundim, R. Droppa Jr., D.d.M. Fonseca, *Physica B: Condensed Matter* **370**, 90-98 (2005) – Y. Méheust, G. Løvoll, B. Sandnes, K.J. Måløy, J.O. Fossum, G.J. da Silva, M.S.P. Mundim, R. Droppa Jr., D.d.M. Fonseca, *Clay Science* **12** Supplement 2, 66-70 (2006).
[3] Lars Ramstad Alme, Water transport in selected nanoporous media, Master thesis – Department of Physics, Norwegian University of Science and Technology (2007)
[4] Eduardo N. de Azevedo, D. Vitoreti da Silva, R. E. de Souza, M. Engelsberg, *Phys. Rev. E* **74**, 041108 (2006) – E.N. de Azevedo, Paulo L. de Sousa, Ricardo E. de Souza, M. Engelsberg, *Phys. Rev. E* **73**, 011204 (2006)