Post-doctoral position: Thermal expansion of adsorbing microporous media and application to clay desiccation

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Key words: poromechanics, adsorption, molecular simulation, clay desiccation, statistical physics

Laboratoire Navier at Ecole des Ponts ParisTech is seeking a post-doctoral fellow to work on the molecular modeling of thermo-mechanical couplings in microporous media with application to clay desiccation.

Clays are nanostructured microporous materials that contain adsorbed water. Clay hydration and dehydration is well known to induce important deformations of the material that may end up to instabilities such as desiccation cracking of soils in dry conditions. Cracking of clay-rich rocks can be detrimental (building foundation, nuclear waste or CO_2 storage, well stability) or beneficial (enhanced fluid transfers for geothermal energy and hydrocarbon recovery). More generally adsorption in microporous solids is known to induce unusual deformations, with large shrinkage or swelling. At the same time, because of their intrinsic heat of adsorption, or because of external heat stimulations (nuclear wastes, industrial processes), microporous solids are often subjected to important temperature variations; which means that their deformation is a complex interplay between temperature, solid mechanics and adsorption. The TEAM2ClayDesicc project, funded by the French National Research Agency (ANR), will focus on the physics of thermal expansion of adsorbing microporous media, in particular clays, with application to the thermal stimulation of clay-rich shales.

In the framework of this project, we offer a two-year postdoc position, which takes place at the beginning of the project, and will be dedicated to the study of thermal expansion of adsorbing media by molecular simulation in order to develop analytical models capturing the coupling between adsorption and thermal expansion. Special attention will be paid to the physical mechanisms that are relevant for clays. Apart from the implementation of numerical molecular simulations of model and more realistic systems, this postdoc will strongly connect to poromechanics, thermodynamics and statistical physics. The outcomes of this work will be used in the following of the project for investigations at larger scales.

This position will be hosted in Navier Laboratory, at the Ecole Nationale des Ponts et Chaussées in Champs-sur-Marne (east of Paris). The position can start anytime and no later than fall 2015. Applicants should hold a PhD degree in physics, mechanics or related areas with a competitive track record. Candidates must be skilled in numerical scientific computing and have previous experience in performing classical molecular simulations (Molecular Dynamics and Monte Carlo). Knowledge of statistical physics, adsorption, clay minerals, or poromechanics is preferred. Applicants must be capable to communicate in good English, including the oral and written presentation of research papers. Interested applicants should contact L. Brochard (laurent.brochard@enpc.fr).

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