FOR APPLICATION, PLEASE CONTACT ADVISOR(S) BY EMAIL WITH COPY TO:
ali.siadat@ensam.eu AND yvon.velot@ensam.eu

Research Topic for the ParisTech/CSC PhD Program

Fields: Environment Science and Technology, Sustainable Development, Geosciences; Chemistry, Physical Chemistry and Chemical Engineering; Energy, Processes; Materials Science, Mechanics, Fluids.

Subfield: Experimental Fluid Mechanics in Porous Media.

Title: Experimental investigation of yield stress fluids flow in porous media with application to the development of a new porosimetry method.

ParisTech School: Ecole Nationale Supérieure d'Arts et Métiers.

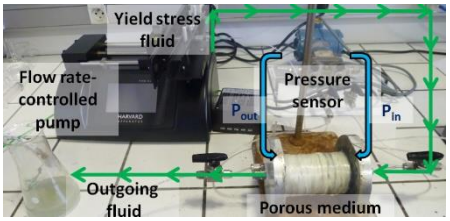
Advisor(s) Name:
Pr. Azita AHMADI-SÉNICHAULT
Dr. Antonio RODRÍGUEZ DE CASTRO
Pr. Abdelaziz OMARI

Advisor(s) Email:
azita.ahmadi-senichault@u-bordeaux.fr
antonio.rodriguezdecastro@ensam.eu
abdelaziz.Omari@enscbp.fr

Lab, website:
Institut de Mécanique et d'Ingénierie de Bordeaux (I2M)
https://www.i2m.u-bordeaux.fr/Recherche/TREFLE-Transfert-Fluide-Energetique

Short description of possible research topics for a PhD: (10-15 lines in English + optional figure)

The Yield Stress fluids porosimetry Method (YSM) to characterize Pore Size Distribution (PSD) of porous media was recently presented as a potential alternative to toxic Mercury Intrusion Porosimetry (MIP). It consists in measuring the flow rate Q at several pressure gradients ∇P during flow experiments of yield stress fluids through porous media. PSD is essential in many industrial processes such as Enhanced Oil Recovery (EOR) or soil remediation. The objective of this PhD thesis is to improve YSM method in order to meet the industrial standards of robustness, accuracy and reliability. To do so, laboratory flow experiments will be conducted on a set of porous media with increasing complexity: 1) microfluidic chips with cylindrical patterns, 2) model granular media formed by packs of spherical glass beads with monomodal or bimodal particle sizes, 3) packs of glass beads with markedly different particle sizes and 4) real or reconstructed heterogeneous 3D porous media. The obtained PSDs will then be compared to those provided by well-established porosimetry techniques. In parallel to laboratory experiments, the method used to extract PSD from the (Q, ∇P) measurements will be improved on the basis of pore-network modelling approaches by considering variable cross-section and connectivity of the pores.



Basic experimental setup

Required background of the student: A solid theoretical and experimental understanding of the fundamentals of fluid mechanics is required. The principles of mathematical programming and numerical methods must be known. Performing experiments requires dexterity, autonomy and meticulousness.

A list of 5(max.) representative publications of the group: (Related to the research topic)
Rodríguez de Castro, A., Ahmadi-Sénichault, A., Omari, A., Using Xanthan Gum Solutions to Characterize Porous Media with the Yield Stress Fluid Porosimetry Method: Robustness of the Method and Effects of Polymer Concentration, Transport in Porous Media 122(2), 357 – 374 (2018).
http://doi.org/10.1007/s11242-018-1011-8
Rodríguez de Castro, A., Ahmadi-Sénichault, A., Omari, A., Savin, S., Madariaga, L.-F., Characterizing porous media with the Yield Stress Fluids porosimetry Method, Transport in Porous Media 114, 213-233 (2016).
http://dx.doi.org/10.1007/s11242-016-0734-7
Rodríguez de Castro, A., Omari, A., Ahmadi-Sénichault, A., Bruneau, D., Toward a New method of Porosimetry: Principles and Experiments, Transport in Porous Media, 101, 349-364 (2014).
http://dx.doi.org/10.1007/s11242-013-0248-5