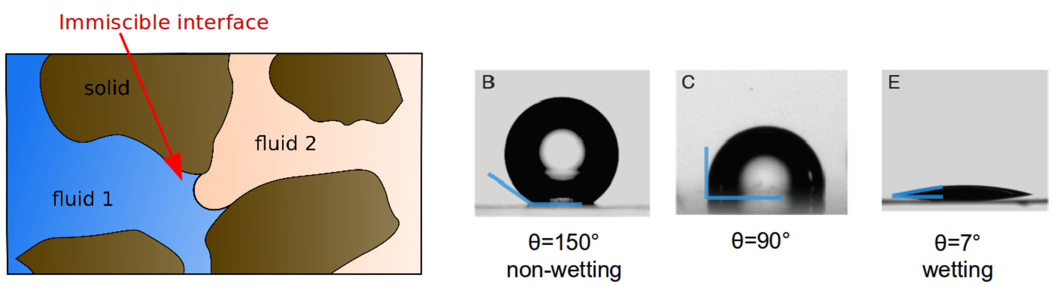
PhD vacancy:

Modelling contact line dynamics in multiphase porous media

CNRS (French National Center for Scientific Research) through the **Earth Sciences Institute of Orléans** (ISTO) has an **open PhD position for 3 years** to decipher and model the interfacial dynamics of multiphase flow in natural porous media.

About the position:

Wettability plays a key role in multiphase flows in porous media[1]. Accurate prediction of multiphase flows in the soils and the subsurface for geo-environmental issues including Carbon Capture and geological Storage, Water resources Remediation or Enhanced Oil Recovery requires an in-depth understanding at the pore-scale of the key mechanisms that influence the fluid displacements and dynamics including viscous and capillary forces but also the solid surface wettability[2-4]. The rock wettability and the resulting multiphase flows can be modified by a change in pore water composition (pH, salinity) and interfacial physical chemical properties. For example, an oil droplet trapped within a pore may be more easily remobilized using low salinity water[5]. Mineral surface wettability is traditionally described considering contact angles[6]. However, flow models based on contact angles break down in the presence of thin water films on the mineral surface. Alternative flow models including lubrication theory offer an appealing framework[7] to account for nanoscale effects due to salinity and surface roughness for instance.



The objective of the PhD thesis is to investigate the physico-chemical mechanisms controlling the wettability of rocks according to pore water chemistry and interfacial properties. **The PhD student will develop a robust simulation framework to predict at the pore-scale in the most realistic and mechanistic way the multiphase transport in geological formations for energy and environmental issues.** The simulation tools will be developed using OpenFOAM combining the Navier-Stokes equations for two-phase flows within the pores (Volume of Fluid and Finite-Volume methods)[8,9] and integrating the Reynolds equations at the mineral surface (equations describing the water film solved on curvilinear surfaces using the Finite Area Method). Microfluidic experiments (Geological Labs on Chip) conducted in the laboratory will be used to check the model predictions[2-4].

Expected starting date: October 2020

About the candidate:

We are looking for a candidate having a Master degree or equivalent with a strong background in applied mathematics and Computational Fluid Dynamics including multiphase flow and porous media. Good programming skills with fluency in C++ is expected. Knowledge of OpenFOAM and interest in geochemistry are a plus.

About us:

ISTO is a joint research laboratory between CNRS, University of Orléans and the French Geological Survey (BRGM) located on the Geosciences campus of Orléans close to Paris, France. The porous media team is developing cutting-edge research and worldwide recognized expertise on pore-scale modelling and microfluidic experiments of multiphase flow and reactive transport in complex geological formations. The PhD candidate will join a network of leading-edge national research institutions including CNRS, BRGM, Sorbonne University, University of Bordeaux and Université de Pau et des Pays de l'Adour, and international collaborations including Heriot-Watt University, Lawrence Berkeley National Laboratory, Princeton University and Stanford University.

To apply please send your CV and cover letter before March 15, 2020 to

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References:

[1]de Gennes, P.-G. (1985). Wetting - statics and dynamics. Rev Mod Phys 57 (3), 827–863.

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