Description of Funded Research Projects
1st Call for H.F.R.I. Research Projects
to support Post-Doctoral Researchers

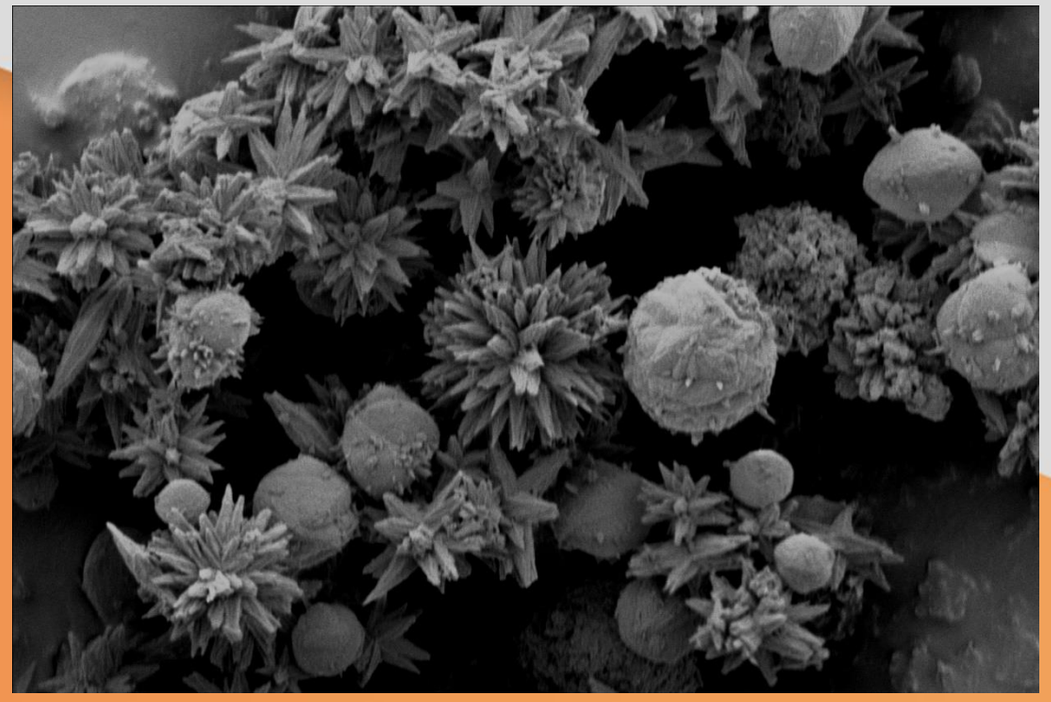
H.F.R.I.
Hellenic Foundation for
Research & Innovation

Research Project Title:

Effect of Pore Surface Wettability on Mineral Scaling, an μFluidic approach

Principal Investigator:

Varvara Sygouni



Popular Title:

Investigation of the effect of pore surface wettability on salt precipitation through experiments in micromodels

Scientific Field:

Engineering and Technology Sciences

Host Institution:

Institute of Chemical Engineering Sciences, Foundation for Research and Technology, Hellas

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Multiphase flow processes taking place during Enhanced Oil recovery, CO2 or gas storage, geothermal energy production and utilization, membrane filtration processes etc., are usually accompanied by undesirable phenomena of scaling. There are cases in which controlled precipitation of sparingly soluble salts is desired, as in waterproofing of underground structures, prevention of soil erosion using consolidation, in biomaterials etc. During past decades, sparingly soluble salt precipitation mechanisms have been investigated in relation with several parameters such as pH, temperature, ionic composition etc.

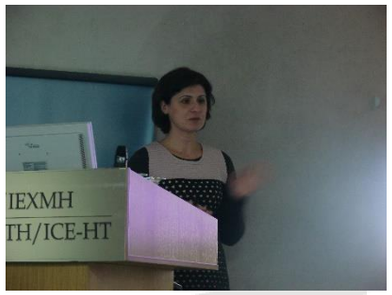
Our recent studies have shown that the presence of organic substances, affects the nucleation process dramatically. However, despite the fact that most of the natural and engineered porous media used in the aforementioned applications are of mixed (fractional) wettability, the parameter of surface wettability has been overlooked up to date. The heterogeneity coming from the change of the contact angle of the supersaturated fluid with the pore surface could be a significant contribution to the driving force for crystal nucleation and growth by itself. Pore surface wettability strongly affects the distribution of fluid interfaces in a porous medium, and consequently nuclei creation may be affected. In the case of organic fluids, parameters such as contact angle of solution with the hydrophobic or hydrophilic pore surface may be the driving forces for nuclei creation.

In this project, such phenomena will be investigated in detail from microscale to bed-scale. More specifically, in WetμFluid, innovative microfluidic technology shall be employed. This technology has been on the spot of research focused on multiphase flow due to the possibility of visualizing ever smaller volumes, in the last decade. Microfluidics may provide a more detailed and representative view of the basic physico-chemical properties of fluids and the underlying mechanisms in nucleation and the growth of sparingly soluble salts on surfaces of varied wettability.

The proposed research is of high interest for a wide variety of applications; oil recovery, enhanced oil recovery (EOR), CO2 and gas storage, in geothermal energy production and utilization and membrane filtration processes, micro-channel devices which have also a wide variety of applications such as biomaterials and biosensors, etc. Additionally, manufacturers of materials for waterproofing of underground structures (e.g. tunnels) or soil erosion are interested in mechanisms of salt precipitation in porous media. Knowledge of mechanisms and consequently control of salt deposition has tremendous economic impact as it may prevent temporary shutdown of industrial processes.

Scientifically, the proposed project aims at providing fundamental knowledge on mechanisms taking place during salt precipitation in porous media of realistic wettability and of the co-existence of other substances which may improve the relative processes and applications with economic benefits for the community.

To me, H.F.R.I. funding would mean...



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The funding of H.F.R.I. gives me the opportunity to work on a subject related to my research experience so far and falls within my research interests. This funding gives the laboratory the opportunity to obtain new experimental devices and to re-create a working group on the specific subject that has not been funded in recent years. In addition, I have the opportunity to coordinate the project and lead the youngest researchers (doctoral candidates, postgraduate students) who will work in this field.

The Principal Investigator,
Varvara Sygouni

Funding

Amount: **119,500 €**

Duration: **36 months**

Foundation: **H.F.R.I.**

H.F.R.I.
Hellenic Foundation for Research & Innovation

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