UNIVERSITY OF AMSTERDAM

Institute of Physics

Research project -Master Proposal

Does a growing crystal exert a pressure in a confined environment?

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The precipitation of salt minerals in confinement, such as pores in porous materials, can induce macroscopic damage to buildings, rocks and oil reservoirs. The growth of the salt crystals them happens within the pore spaces of the material, implying that mechanical stresses develop on the scale of individual grains: at the microscale. A condition for damage to occur is that the crystal continues to grow even in confinement, and that the resulting stress damages the rock. We have shown previously that indeed a crystal growing from a supersaturated solution can generate a force on the confining wall. An important condition for this to happen is the existence of a thin film of supersaturated solution that separates the crystal face from the wall during its growth. However, the thickness of and the salt concentration in this thin film remain unknown as well as the force that keeps it in place.
During this project we will use a novel method developed in our lab to *directly* measure the force exerted by a growing microcrystal in a confined geometry under controlled environmental conditions[1]. This new method allows us to follow the nucleation and spontaneous growth of a micro crystal from the salt solution between two glass plates and to simultaneously measure the subsequent force developed at the pore scale.

Parameters that will be investigated are:

-To see what keeps the film in place, and what gives its thickness, the role of the wetting properties of the glass plates will be investigated. For this purpose, thin film deposition by spin coating on glass substrate will be done as well as hydrophobization of the glass slides by chemical silanization.

-To see what crystal parameters are important we will study the controlled growth of sodium chloride crystals from its different faces between the two plates.

-The thickness of the thin liquid film separating the crystal face from the wall will be investigated in different experiments using interferometry.

Reference

1. Desarnaud, J. ; Bonn, D.; Shahidzadeh , N.; The pressure induced by salt crystallization in confinement, Scientific Reports, 6, 30856, 2016
2. Naillon, A.; Joseph, P.; Prat, M.; *Phys. Rev. Lett* , **2018,** 120, 034502