Modeling of diffusion induced membrane formation

Host Laboratory : Physique de la Matière Condensée, École Polytechnique

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Phd: yes

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Water filtering membranes are a nm thin layer of polymers. To make them mechanically stable they are attached to a porous layer of a a few μm. The properties of this membrane supporting layer have a dramtic effect on the effectiveness of the membrane and on its durability.

This porous layer is formed during a phase separation process between a polymer ad a solvant (spinodal decomposition). This can be induced either by a temperature change or by the diffusion of the solvant outside of the mmixture or by the diffusion of a non solvent inside the mixture. In all cases, the homogeneous mixture evolved toward a state where polymer rich regions coexist with polymer poor regions.

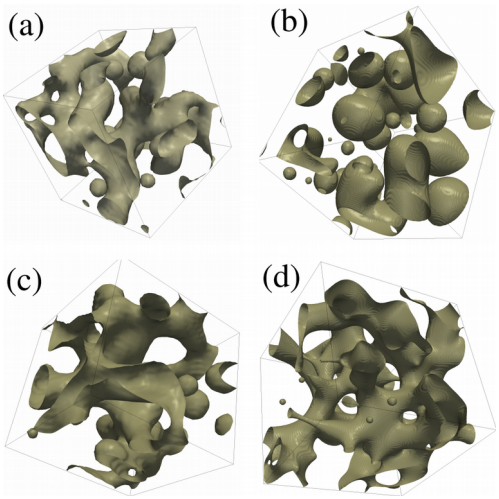

Illustration 1: Typical patterns obtained in fluids during phase separation.

While the mechanism leading to the membrane microstructure are well known it is difficult to link the membrane properties ith the details of the chemical process because of the complicated geometrical structure that are present (see fig. 1). During this internship we will develop a mathematical model of the phase separation induced by diffusive transport and we will study the patterns obtained in a simple geometrical setup.

The internship may be followed by a PhD thanks to an ANR funding. During the PhD the effects of visco elastic fluid flow will be studied.