Prérequis

- Mécanique des fluides (L3, M1)
- Physique des interfaces et du contact (M1)
- Matière molle et biophysique (M1)
- Continuum mechanics and heat transfer (M2)
- Rheologie des fluides complexes (option M2)

Bibliographie "mousses"

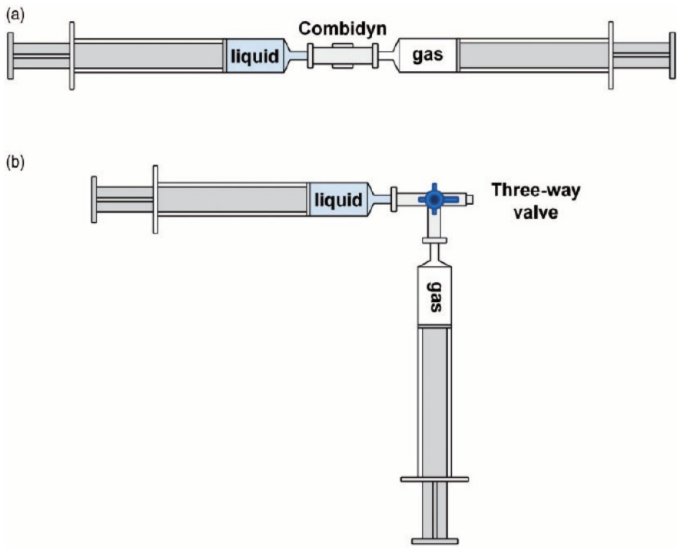
- "Les mousses : Structure et dynamique", Cantat et al., éd. Belin
- F. Graner, C. Quilliet, "Les mousses à loeil nu", La Recherche, 370, 48-49, décembre 2003. http ://graner.net/francois/publis/LaR_mousse_oeil_nu.pdf
- M. Vignes-Adler, F. Graner, "La vie des mousses liquides", Pour la Science 293, 48-55, mars 2002. http ://graner.net/francois/publis/PlaSc_vie_mousses.pdf

Bibliographie "rhéologie"

- http ://www.wikiwand.com/en/Rheology
- "Rhéophysique, la matière dans tous ses états", Coussot, EDP Sciences
- "Rhéophysique, ou comment coule la matière", Oswald et al., Belin
- "An introduction to rheology", Barnes et al., Elsevier 1989
- "Understanding rheology", Morrison, Oxford 2001
- "The structure and rheology of complex fluids", Larson, Oxford 1999
- "Rheology : principles, measurements and applications", VCH Publishers 1994

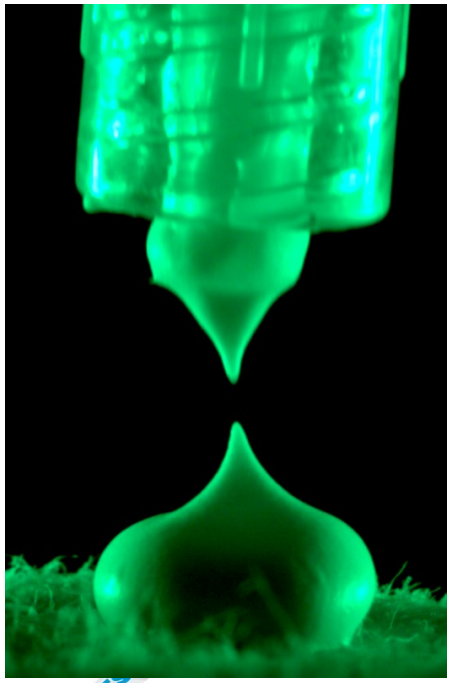
Introduction

Composition
Mélange liquide-gaz



Tessari method

Comportement mécanique
(visco)élastique - (visco)plastique



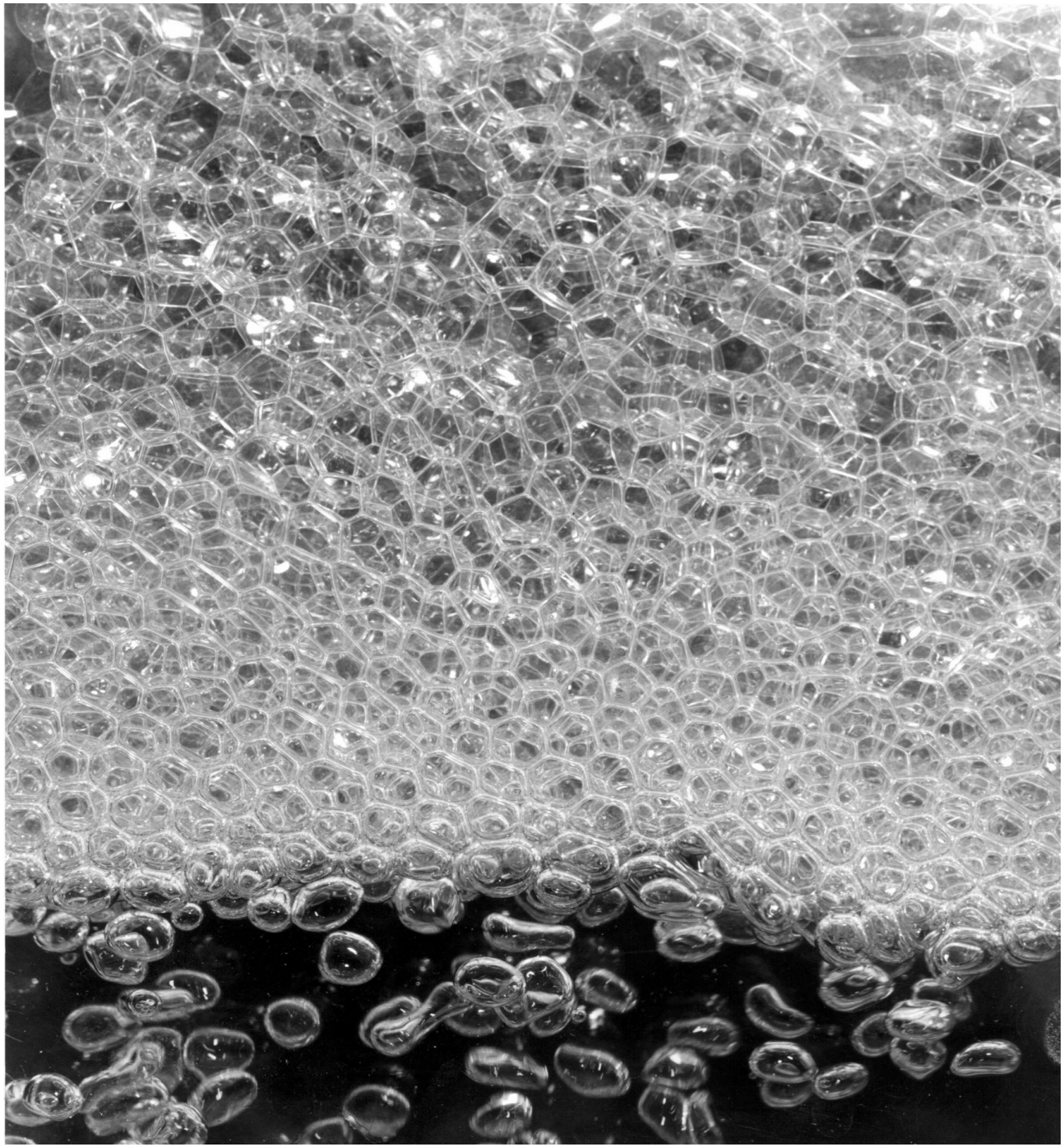
extrudeur de mousse

« chocolate » kiss

ketchup

Physique et rhéologie des mousses liquides

Composition



Dispersion de bulles en contact
au sein d'une phase liquide continue

Gaz

+

Liquide

+

surfactants

Mousse en cours de formation
par bullage

Applications

prévention d'incendie

https://www.youtube.com/watch?v=wYAOHYKBYas

flottation (séparation de minerais)

agroalimentaire,
cosmétique

absorption d'énergie

https://www.youtube.com/watch?v=0lITO518xKI

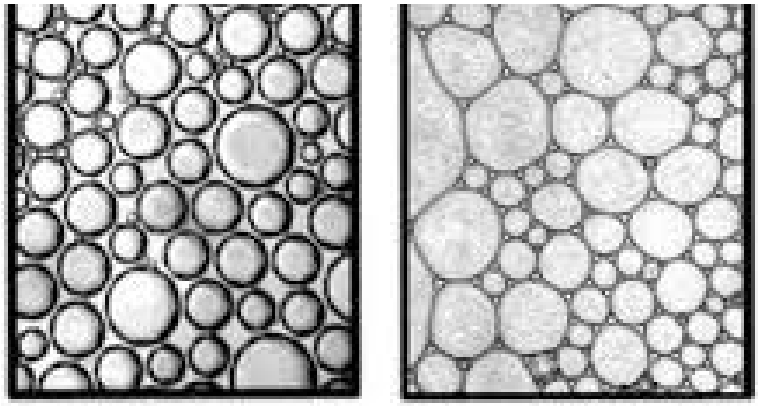
Nature

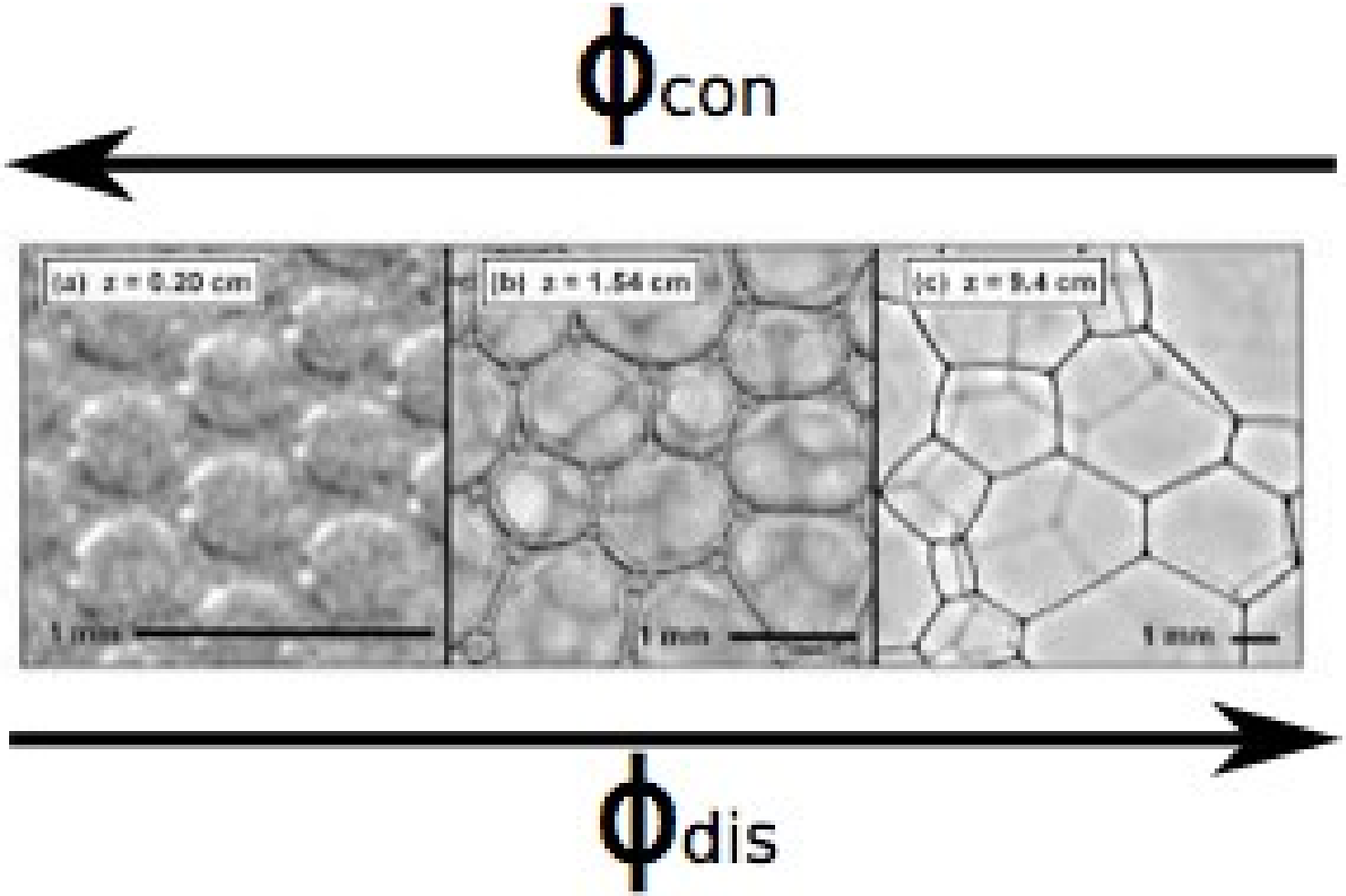
Crachat de coucou

Pierre ponce

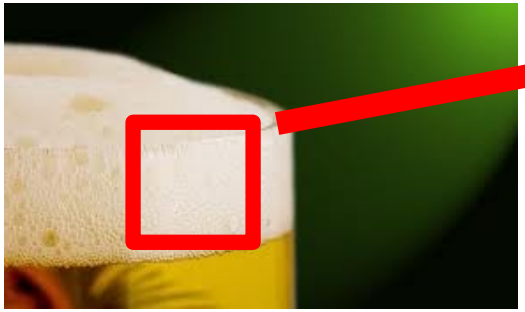
Fraction liquide

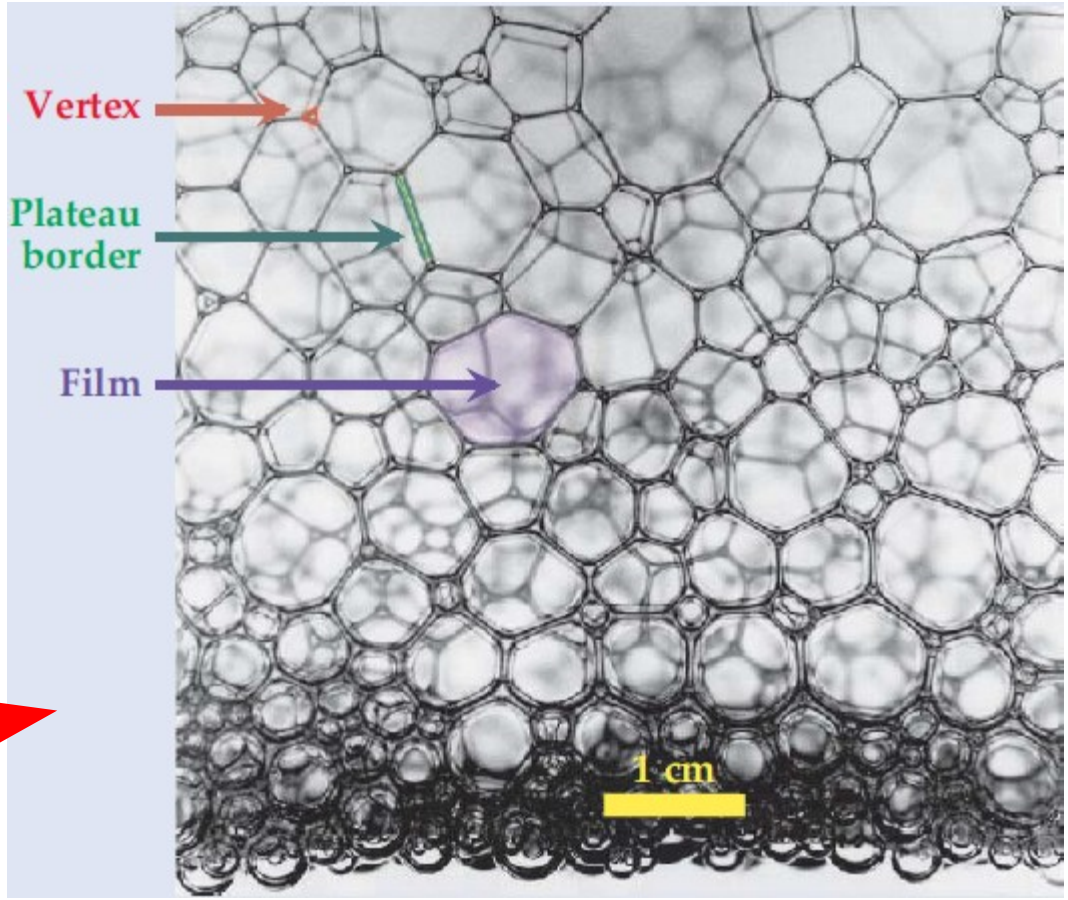
Différentes fractions liquides





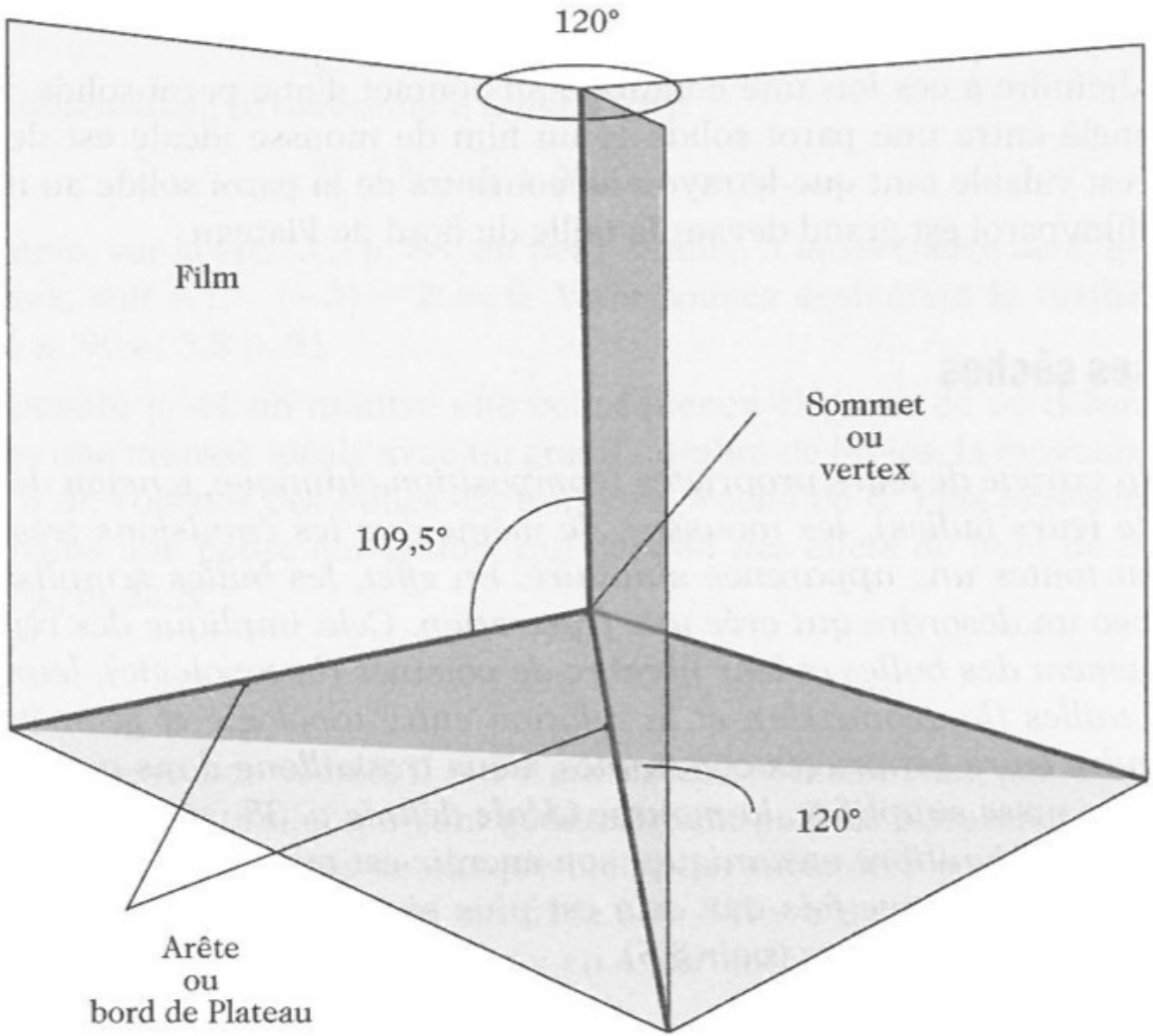
Structure et Répartition du liquide



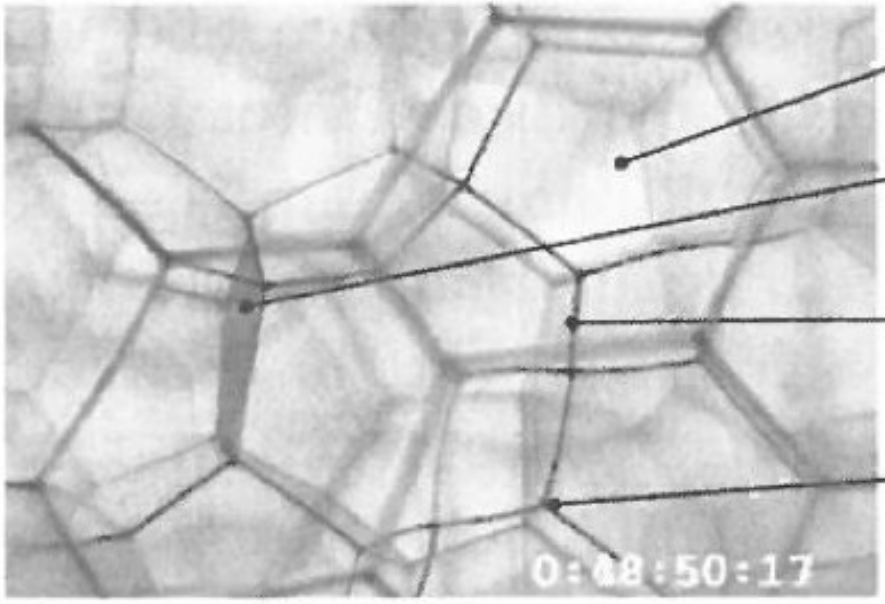


rayon bulles 100µm-1cm
épaisseur films de savon 100nm-10µm

Géométrie



Géométrie

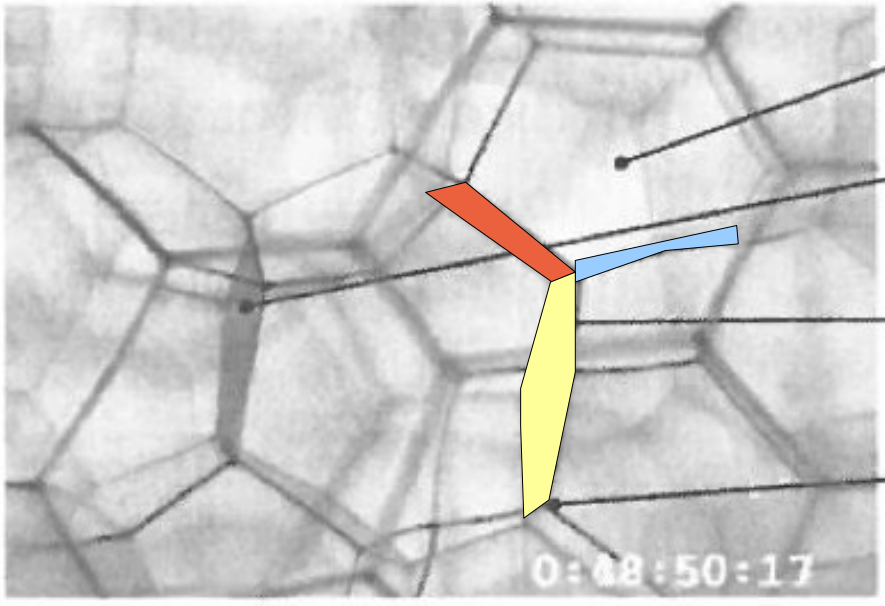


Bulle

Face
(film de savon)

Arête
(bord de Plateau)

Sommet
(vertex
ou nœud)



Bulle

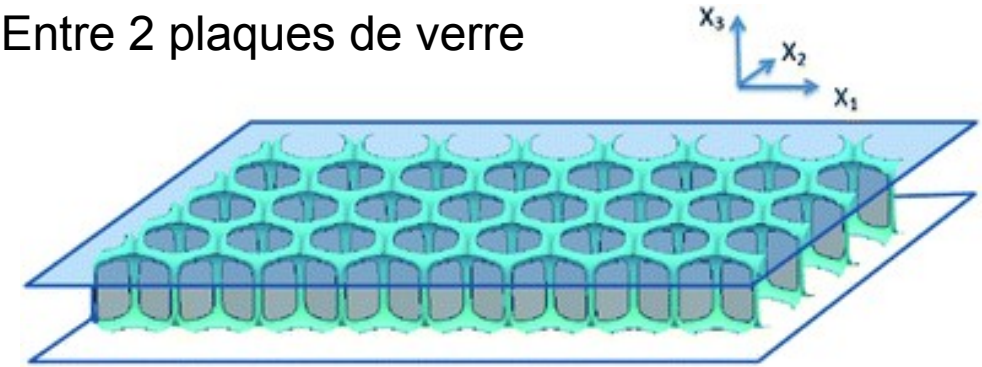
Face
(film de savon)

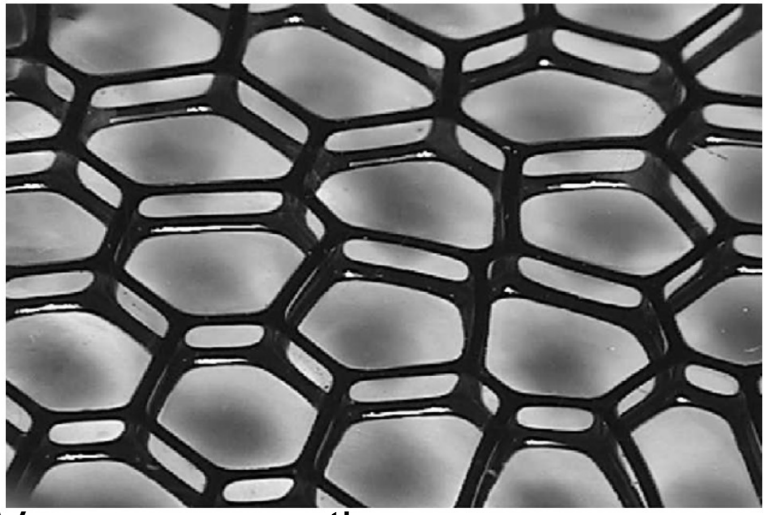
Arête
(bord de Plateau)

Sommet
(vertex
ou nœud)

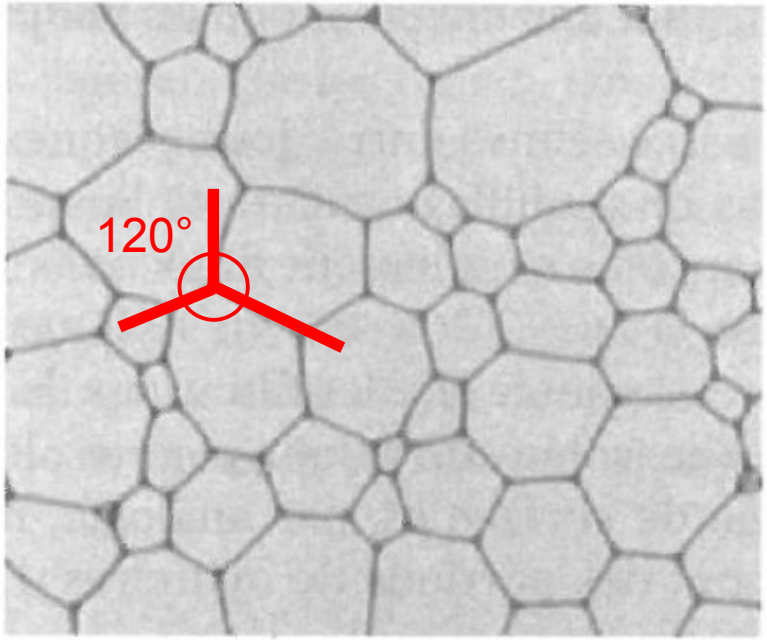
Mousses confinées

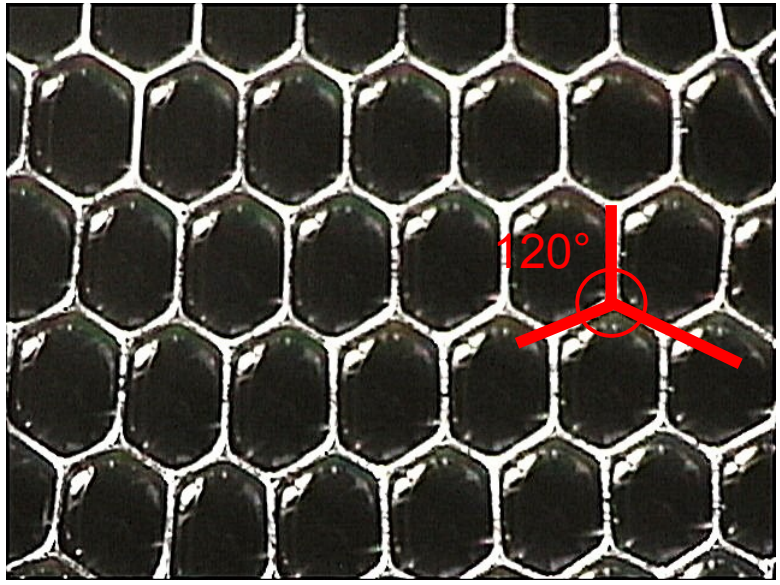
Entre 2 plaques de verre





Vue en perspective

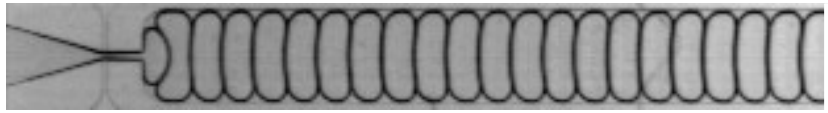




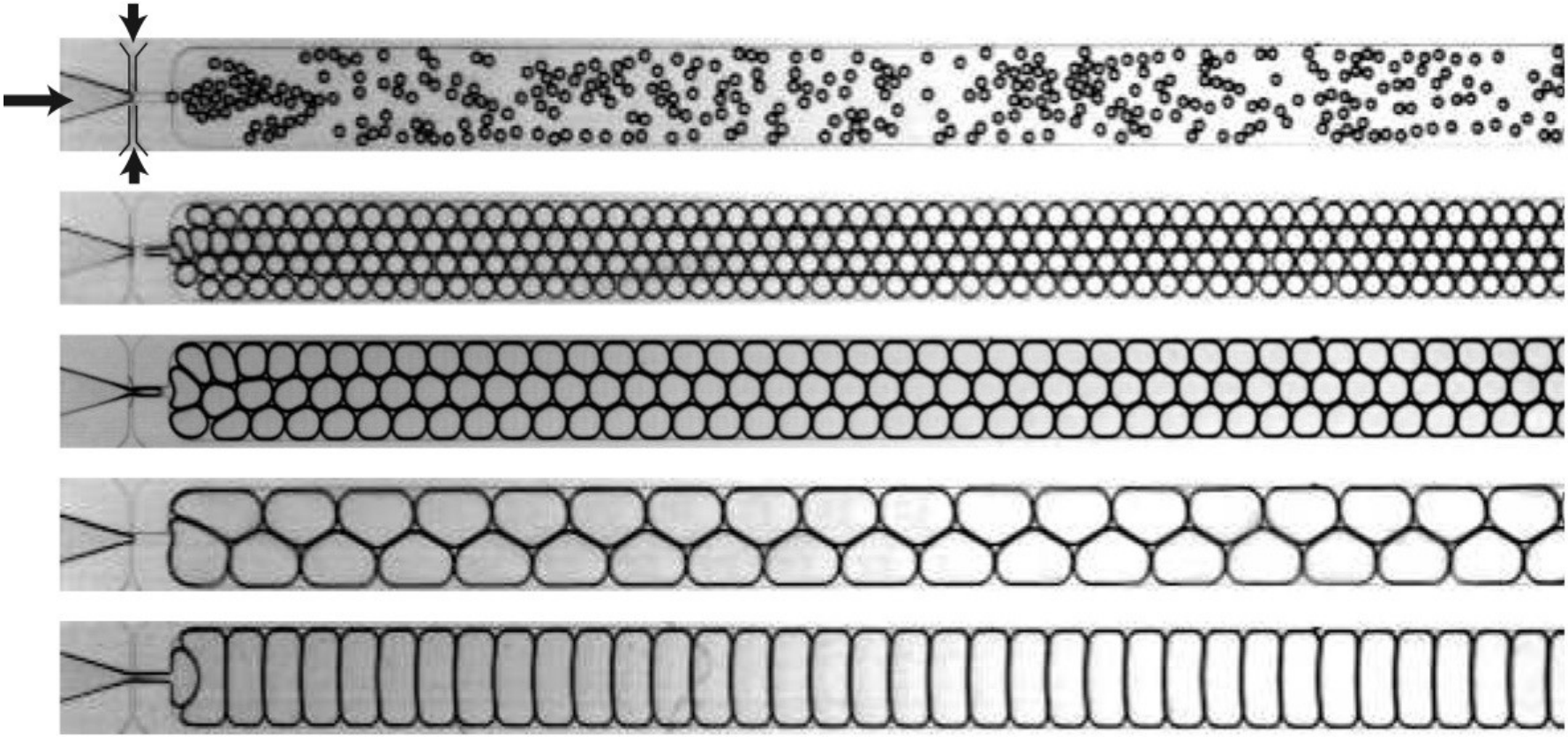
Arrangement en nid d'abeilles (hone

Effet du confinement sur la structure

Utilisation de la microfluidique :
obtention de mousses contrôlées et confinées



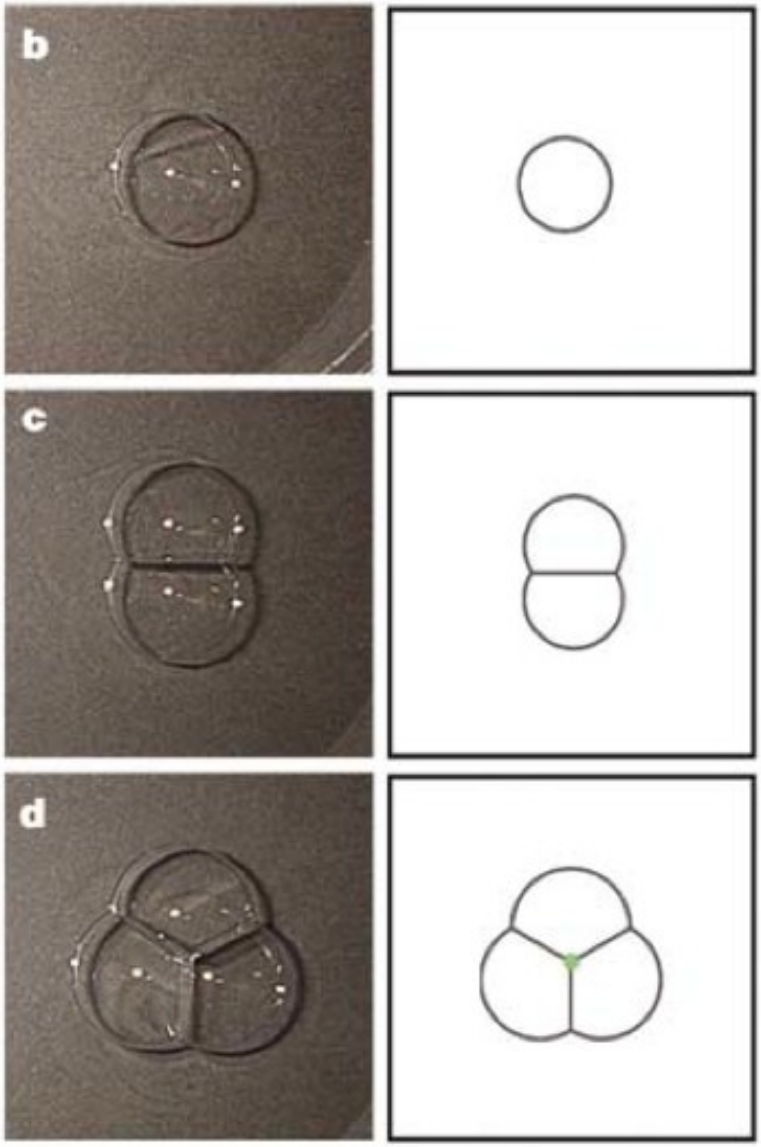
100 µm



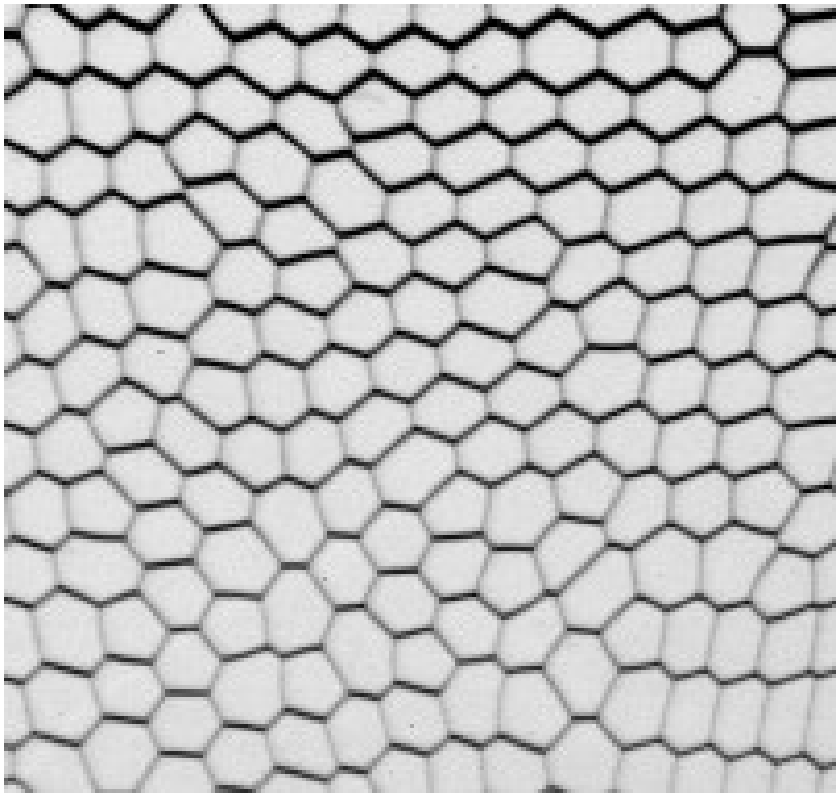
Raven et Marmotant, PRL 2009

Arrangement de bulles

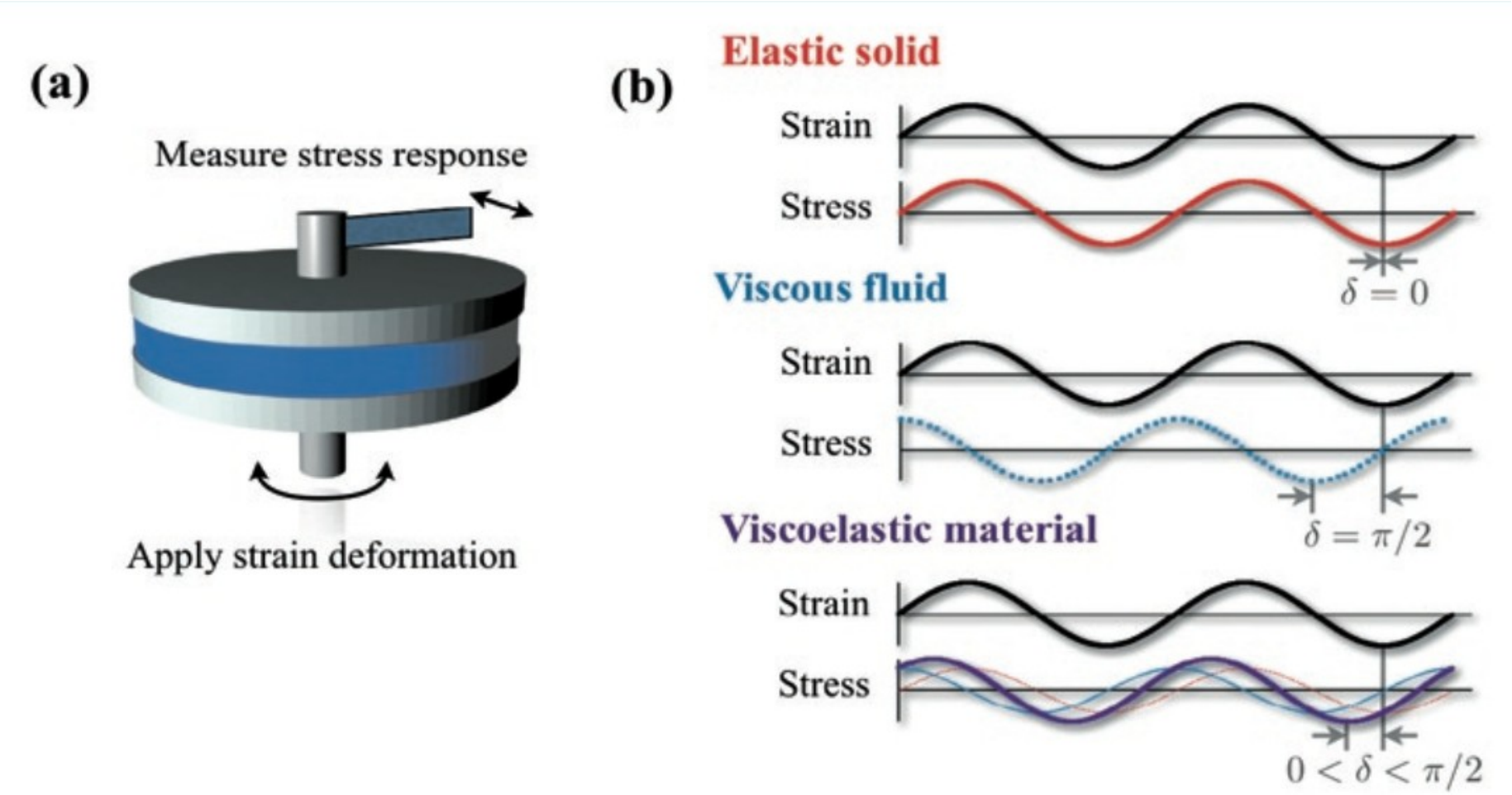
de 1, 2, 3 bulles ...



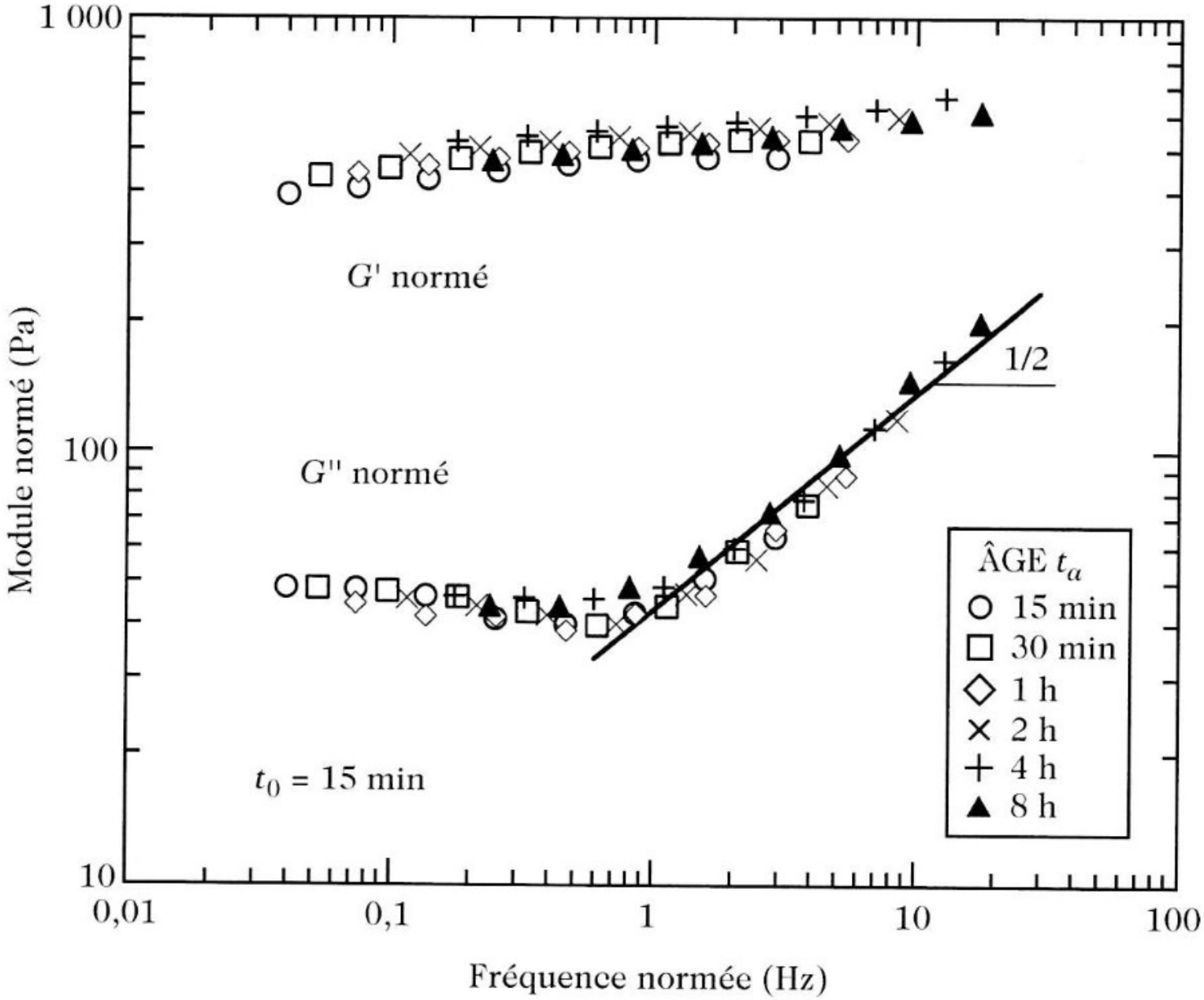
... à N bulles



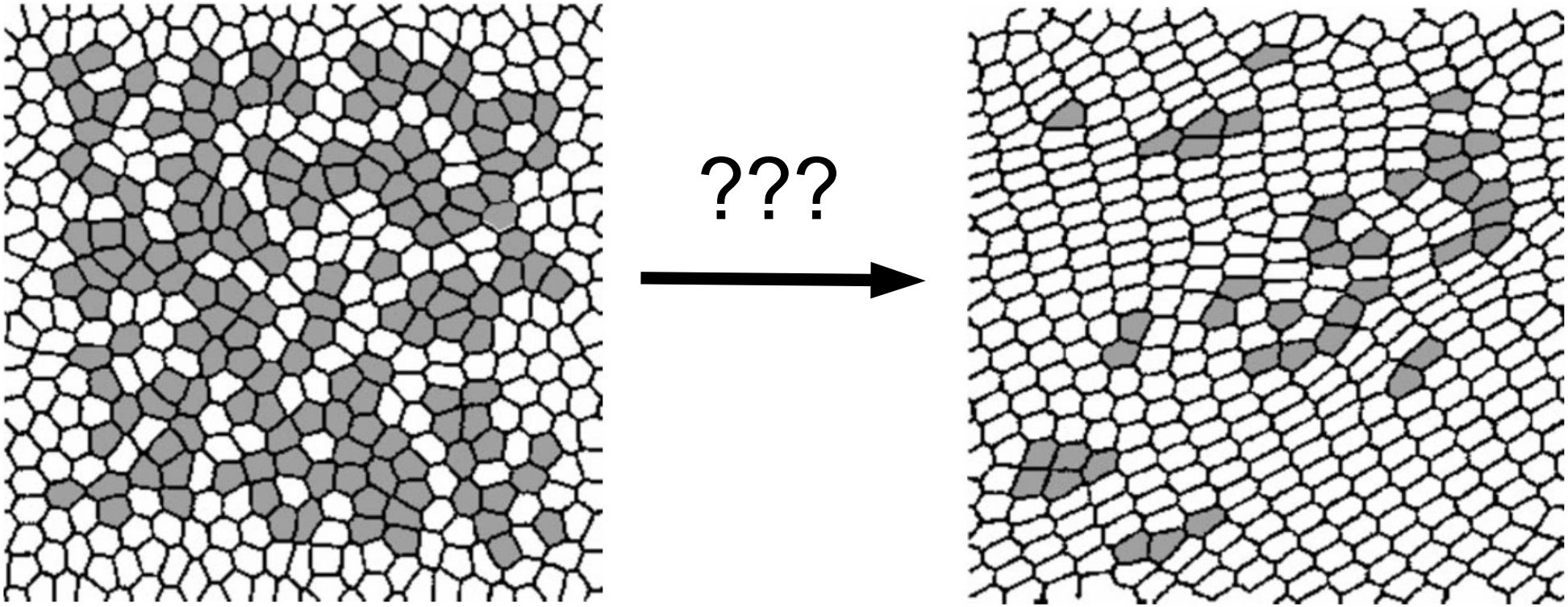
Réponse oscillatoire



Réponse dynamique à faible amplitude

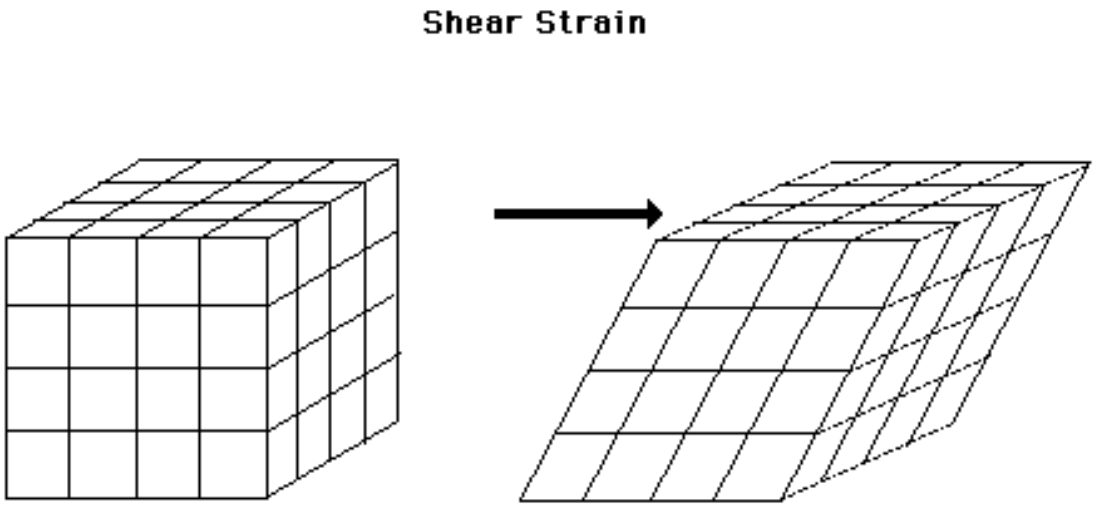


Elasticité

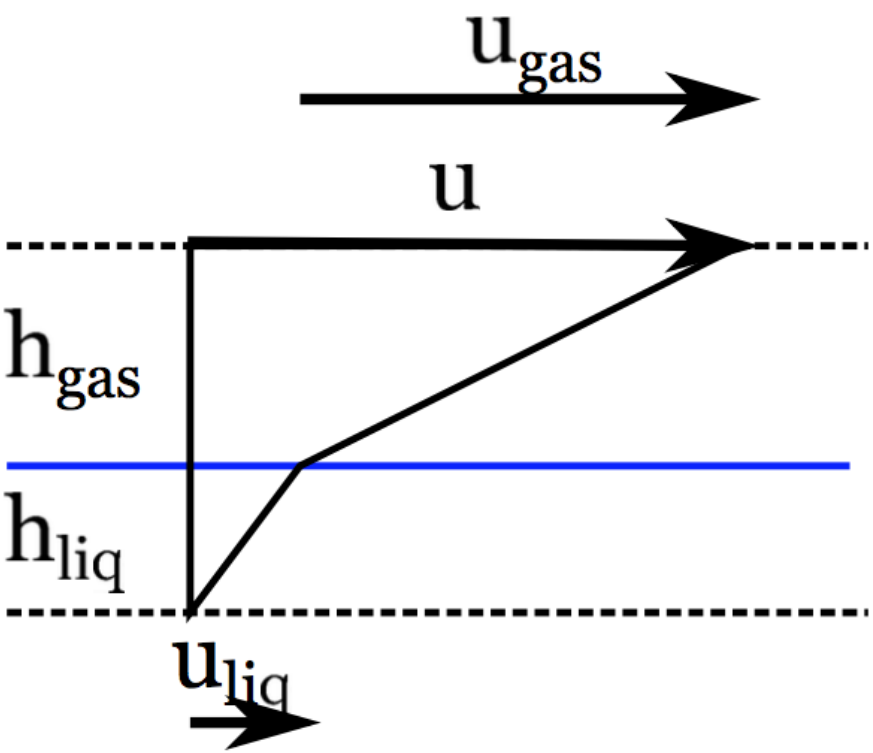


simulation Mousse 2D, Simon Cox

Mousse cubique

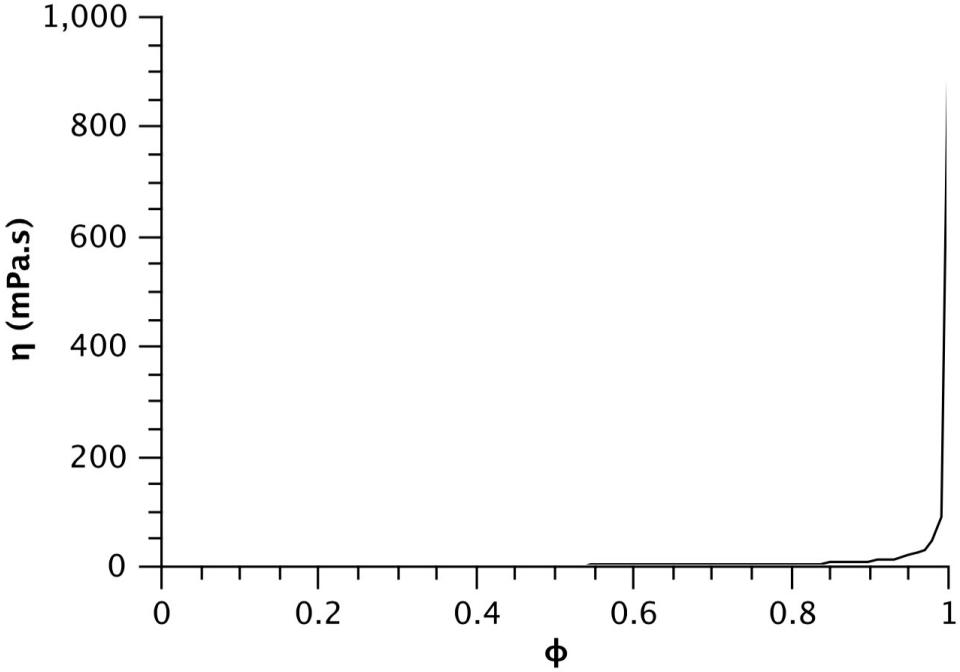


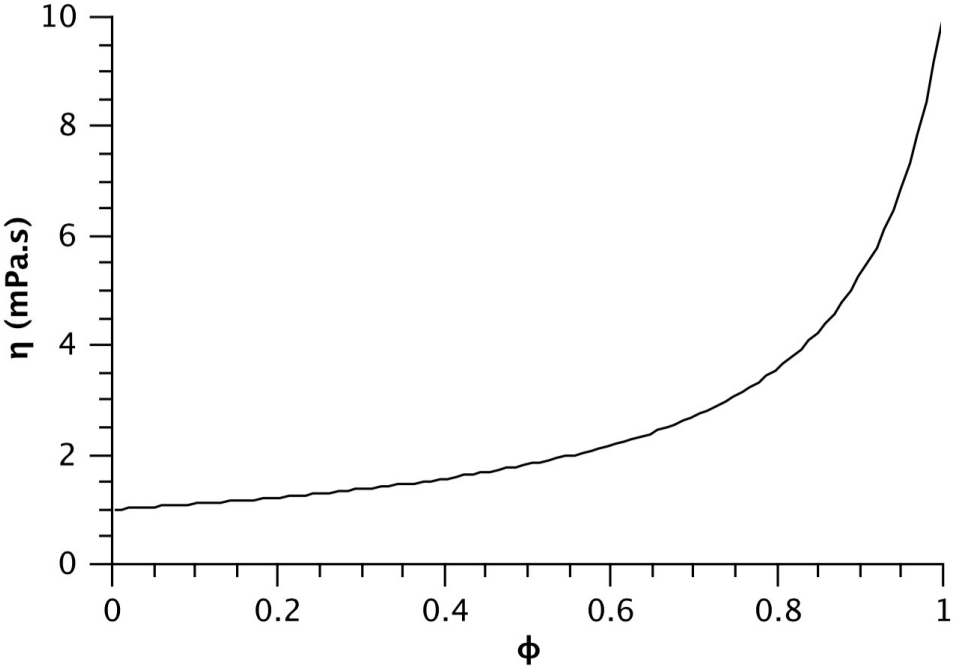
Modélisation de la viscosité



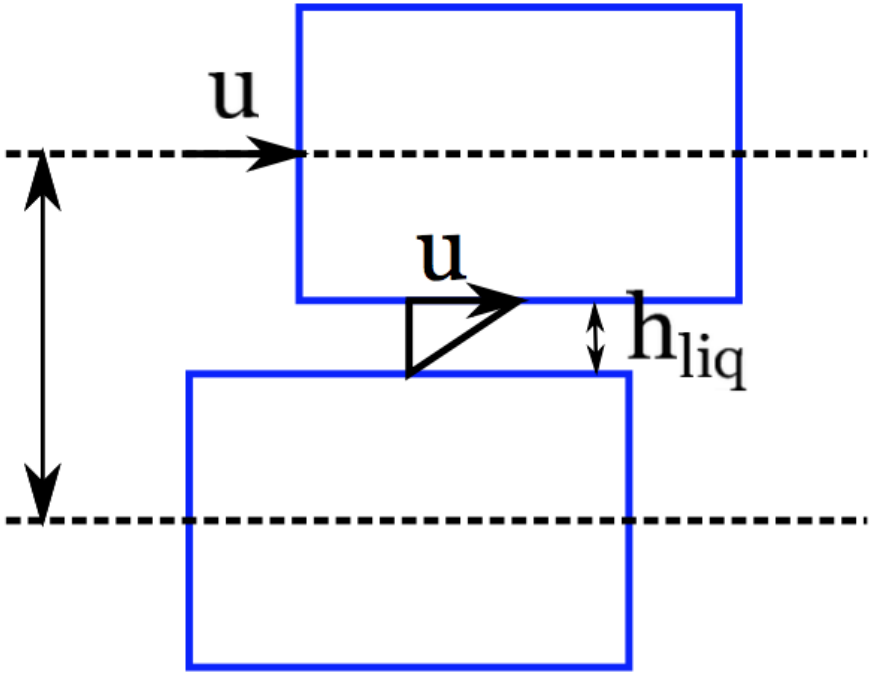
Modèle biphasique simple

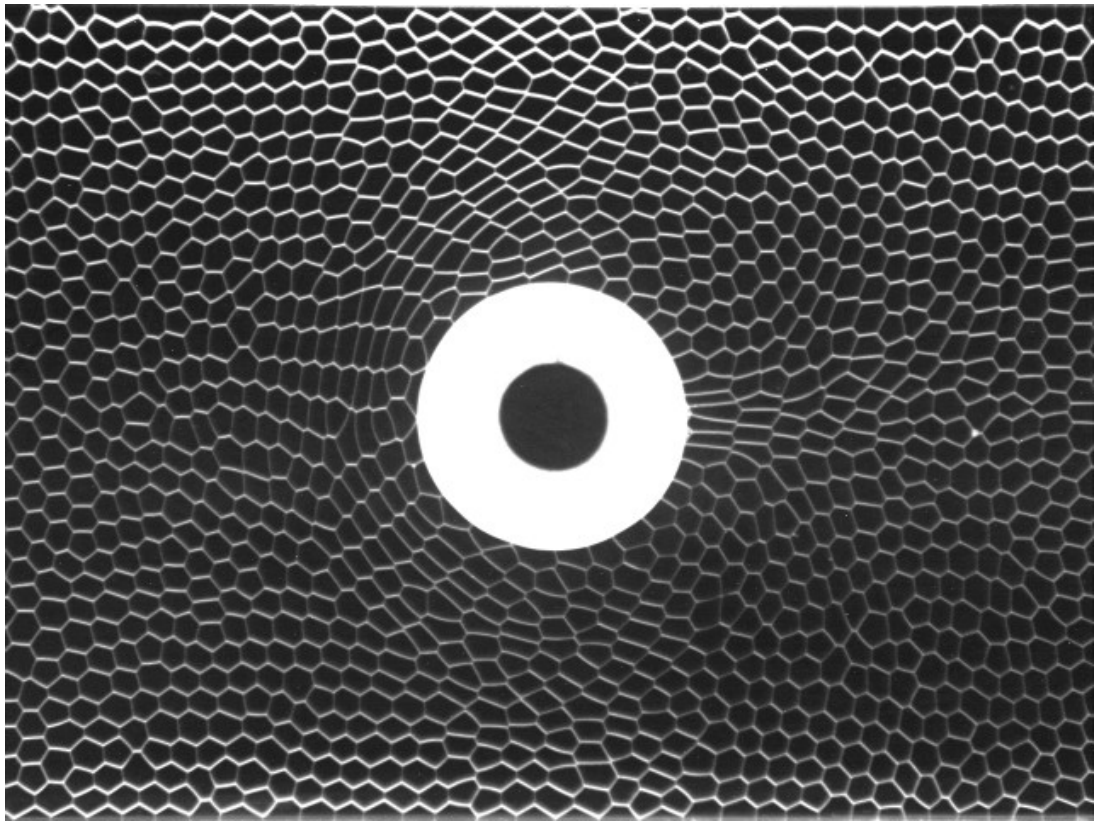
Viscosité effective





Modélisation de la viscosité



Modèle bulles rigides

Expérience de Stokes à 2D