From Thermal Permeation to Thermal Transpiration

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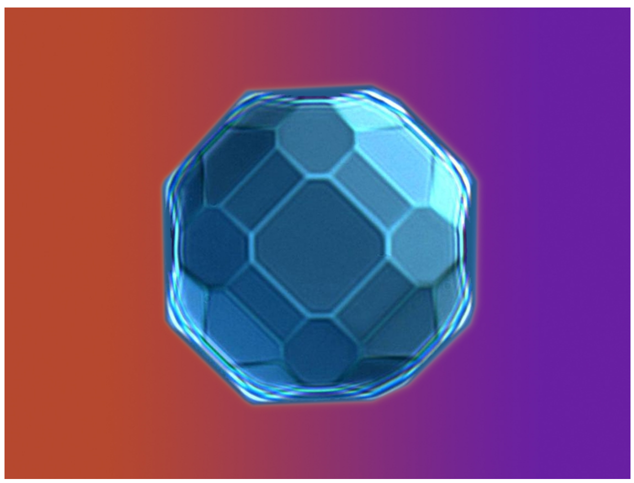
Inverted cubic lyotropic crystals can be seen as porous materials in which the matrix, made of a periodic liquid surfactant bilayer, is filled with water.



Im3m monocrystal in a temperature gradient.

After a short introduction to equilibrium properties resulting from this structure, we will focus on one of the out-of-equilibrium effects: changes in crystal shapes driven by temperature gradients. The search for an explanation of this effect will give us an opportunity to spend a while with Pierre-Gilles de Gennes and James Clerk Maxwell who worked respectively on theories of thermal permeation of liquids(1) and thermal transpiration of gases(2) through solid porous materials. We will also invoke remarkable experiments of Osborne Reynolds(3) on thermal transpiration that lead him to conclude about "*heterogeneous structure, not a continuous plenum*" of gases.

References
(1) Pierre-Gilles de Gennes, "*Effet Soret intrinsèque d'un poreux impregné*", C.R.A.S., **1982**, *295*, 959.
(2) James Clerk Maxwell, *"On stresses in rarefied gases arising from inequalities of temperature"*, **1879**, *170*, 231.
(3) Osborne Reynolds, "*On certain dimensional properties of matter in the gaseous state*", Phil. Trans. Roy. Soc., **1879**, *170 part II,*727.