Porous activated carbon promotes gas hydrate formation and growth via continuous hollow-fibre extrusion from surface macropores.

Saphir Venet[1], Hannelore Derluyn[1], Fabrice Guerton[1], Peter Moonen[2], Patrick Bouriat[1], Daniel Broseta[1], and Ross Brown[3]
[1] Université de Pau et des Pays de l'Adour, E2S UPPA, CNRS, Total, LFCR, Pau, France
[2] Université de Pau et des Pays de l'Adour, E2S UPPA, CNRS, IPREM, Pau, France
[3] Université de Pau et des Pays de l'Adour, E2S UPPA, CNRS, DMEX, Pau, France
e-mail address: saphir.venet@univ-pau.fr

Applications of gas hydrates like water treatment and desalination, or gas storage or separation are hampered by the formation of thin but impervious polycrystalline hydrate crusts on water-guest interfaces, that quickly choke off further crystallization.

Here, cyclopentane hydrate grows continuously on activated carbon beads close to a water-guest interface, circumventing this mass-transfer bottleneck. Optical microscopy and X-ray radiography reveal continuous extrusion of hollow fibres of hydrate from macropores at the external surface of the beads. Comparison with growth of hydrate tubes in glass micro-capillary model pores inspires a simple qualitative and semi-quantitative model of the extrusion process, from which generic features may be distinguished from those specific to growth on the carbon beads.

We thus show that the puzzling apparent growth of the fibres from their roots on the bead surface is an unexpected manifestation of the classic process of hydrate halos.

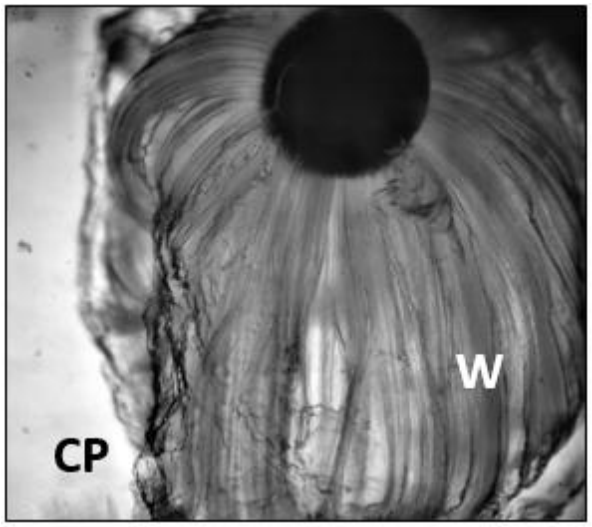

FIG. 1.
Transmission image of hydrate whiskers growing from an activated carbon bead (in black, diameter 300 µm) near an interface between water (W, right) and cyclopentane (CP, left).

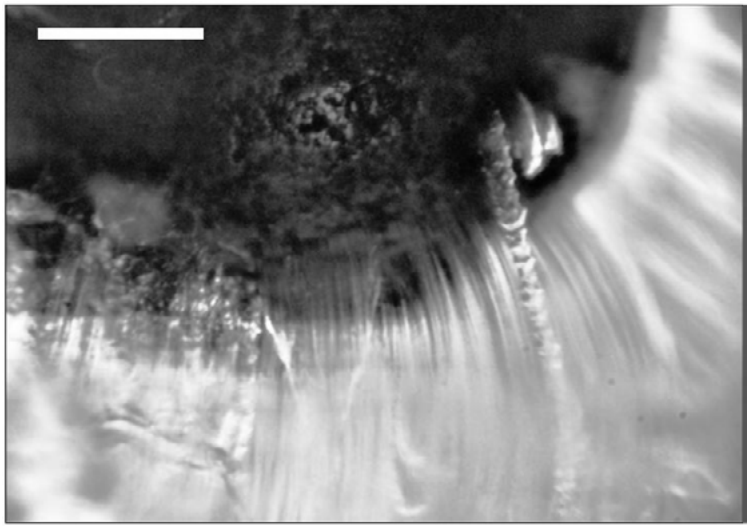

FIG. 2.
Dark-field image of a cascade of CP hydrate fusing out of the rough surface of an activated carbon bead positioned in the water compartment very near the water/CP interface (located above the bead and not apparent here) (scale bar: 200µm).