



Contribution ID: 41

Type: **Oral Presentation**

The swelling and shrinking of a thermo-responsive hydrogel

Thursday, 2 June 2022 09:40 (15 minutes)

Thermo-responsive hydrogels are a promising material for creating controllable actuators for use on micro-scale devices, because they expand and contract significantly (absorbing or expelling fluid) in response to relatively small temperature changes. Understanding the dynamic behaviour of such systems can be difficult because of the spatially- and temporally-varying properties of the gel, and the complex relationships between the elastic deformation of the polymer structure, the fluid dynamics within the pore spaces and chemical interaction between the polymer and fluid. We investigate such a gel using a poro-elastic model, considering the dynamics of a homogeneous thermo-responsive spherical hydrogel after a sudden change in the temperature that should result in substantial swelling or shrinking. We typically find that swelling and shrinking have qualitatively different behaviour: swelling happens smoothly from the edge, whereas shrinking results in the formation of an inwards-travelling spherical front that separates a swollen core and shrunken shell. An approximate analytical form for the front dynamics is developed that well-approximates the numerical solutions.

Acceptance of the Terms & Conditions

[Click here to agree](#)

MDPI Energies Student Poster Award

No, do not submit my presentation for the student posters award.

Country

United Kingdom

References

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Online

Primary authors: BUTLER, Matthew (University of Birmingham); MONTENEGRO-JOHNSON, Tom (University of Birmingham)

Presenter: BUTLER, Matthew (University of Birmingham)

Session Classification: MS04

Track Classification: (MS04) Swelling and shrinking porous media