Contribution ID: **968** Type: **Poster Presentation**

Flow, heat, and transport at the scale of grains and pores in porous building materials

Tuesday, 23 May 2023 16:10 (1h 30m)

The transport of moisture and heat through building materials ultimately dictates their insulation performance over its lifetime. However, characterisation of building materials is challenging because porous building materials are heterogeneous and their macroscopic physical properties (e.g. permeability, thermal, and mechanical) depend on their micro scale characteristics, i.e. the local distribution and features of the solid components and the connectivity of the spaces between them. Large-scale testing can measure these macro-scale properties, but often does not give insight into the underlying structural properties that ultimately leads to optimisation. Thus, a knowledge of the 3D structure is therefore required to assist in the development and implementation process. Experiments combining X-ray microtomography with numerical modelling are an accepted method of studying pore scale processes and have been used extensively in the oil and gas industry to study highly complex reservoir rocks. However, despite the obvious similarities in structure and application, these techniques have not yet been widely adopted by the building and construction industry.

We have experimentally investigated the pore structure of several building materials using X-ray tomography and direct numerical simulation. Four samples were imaged at between a 6 and 15 micron resolution inside a micro-CT scanner. The porosity and connectivity were extracted with the grain, throat, and pore size distributions using image analysis. The permeability, moisture transport, and heat flow were then solved using GeoChemFoam, our highly versatile and open-source numerical solver. The heat and transport were then upscaled to create a custom heat and transport dispersivity for each material. This is the first multi-scale study of structure, flow and transport on building materials and this workflow could easily be adapted to understand and improve designs in other industries that use porous materials such as fuel cells and batteries technology, lightweight materials and insulation, and semiconductors.

Participation

In-Person

References

MDPI Energies Student Poster Award

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

Country

United Kingdom

Acceptance of the Terms & Conditions

Click here to agree

Energy Transition Focused Abstracts

This abstract is related to Energy Transition

Primary authors: MENKE, Hannah (Heriot-Watt University); MAES, Julien (Heriot-Watt University); SINGH, Kamaljit (Heriot-Watt University)

Presenter: MENKE, Hannah (Heriot-Watt University)

Session Classification: Poster

Track Classification: (MS22) Manufactured Porous Materials for Industrial Applications