Upscaling towards Applications: Water Transport in Agglomerates

Magdalena Janota
University of Surrey, UK

Objectives:
This research focuses on understanding anomalous water transport in hydrate agglomerates in terms of changing microstructure by pore-size resolved magnetic resonance imaging (MRI) measurements.

Water transport in cement

The durability of concrete is closely related to the transport properties of water within the cementitious matrix. Water carries aggressive ions such as sulfates and chlorides that causes corrosion thus damage the material.

Sample preparation

To prepare samples for sorption experiments, 60 mm cylindrical white cement paste samples with water to cement ratio between 0.4 - 0.6 are cured in a calcium hydroxide solution for 3 months. Samples are dried with different degrees of saturation, and then compared.

Why MRI?

Magnetic resonance imaging (MRI) is a powerful non-destructive method used to visualise where water is within a sample but also, through spin relaxation time contrast, used to provide information on the locally filled pore size distribution. We use 1D SPRITE MRI methods to distinguish water in hydrate interlayer, gel (nanometre) and capillary (micron) sized pores during repeated wetting and drying cycles.

How do drying and wetting cycles affect cement microstructure?

This MRI study shows that drying severity and sorption history influence C-S-H microstructure and so permeability/diffusivity. Pore size redistribution with different porosity relaxation time is observed depending on the sample history.