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Understanding CO₂ transport and carbonate formation in portland cement-based materials using X-ray micro-CT

Tuesday, 31 May 2022 10:45 (15 minutes)

Two experimental studies focused on understanding the reactive transport properties of CO₂ in cement-based materials are discussed. In the first study, we investigate the kinetics of water sorption into air-entrained mortar specimens when purged with different gas phases CO₂, CH₄, and N₂. The rate of water sorption in the presence of different gases was measured using an engineered flow system built inside an X-ray micro-computed tomography (CT) scanner located at the U.S. Department of Energy's National Energy Technology Laboratory. The CO₂-purged specimen absorbed water 200 times faster than N₂- and CH₄-purged specimens revealing that the role of gas solubility and reactive sorption is expedited in the presence of CO₂ in portland cement-based materials. In a follow-up study, the influence of both the CO₂ state (gas, liquid or supercritical) and different degrees of saturation (0, 50, or 100%) on the transport properties and carbonate formation in portland cement-based materials was studied using the same X-ray micro-CT setup. It was found that the fluid transport, as well as the extent and formation of carbonates in different pore sizes change with the degree of saturation. These findings have implications for predicting mass transport in cement-based materials, ensuring the long-term safety of carbon storage structures, and sequestering CO₂ in the form of carbonates.

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References

Time Block Preference

Time Block B (14:00-17:00 CET)

Participation

Unsure

Primary author: Ms DALTON, Laura (North Carolina State University)

Co-authors: Dr CRANDALL, Dustin (US Department of Energy - National Energy Technology Laboratory); Mr JARVIS, Karl (Leidos Research Support Team); Dr POUR-GHAZ, Mohammad (North Carolina State University)

Presenter: Ms DALTON, Laura (North Carolina State University)

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