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Dynamic CO2 retention in earthen materials. Application to the Indoor Air Quality (IQA) improvement capacity of earth-based plasters.

Abstract:

To mitigate the GHG emissions from the operational energy consumption in buildings, increasingly high-performance envelopes for buildings are developed. In consequence, a reduction in indoor air renewal is observed and consequently a strong reliance on mechanical ventilation reducing the energy efficacy. In addition, highly airtight buildings often present higher pollutant concentrations in the built environment with consequences on Indoor Air Quality and the health of occupants.
Thus, delegating part of the automated control to a passive regulation system appears to be a promising solution since it can be beneficial to reduce energy consumption of HVAC systems, to improve the IAQ and to increase the resilience of buildings. Earth-based materials present promising characteristics for such function, through the presence of clay minerals and their microstructure they present high adsorption capacity and there is an absence of emission of pollutants from the material itself.
The aim of this work is to focus on the CO_2 adsorption in earth-based building materials. CO_2 is an anthropogenic gas that is often used as an indicator of air quality, there is also evidence for its impact on health at relatively low concentrations.

Results and Discussion:

In order to study the physico-chemical interactions occurring at pore scale a new experiment was developed. It is based on the coupling between TG-DSC device, a gas mixer, and a wet gas generator. Variations in mass and heat induced by the interactions between the injected gas (mixture of dry air, water vapour and CO_2) and the clay material were measured and analyzed. The accuracy of the adsorbed mass measurement was verified with a modified DVS system. Reversibility and adsorption kinetics were studied and provide indications on the potential for passive indoor pollutant buffering.