Multi-scale characterization of porous building materials

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ABSTRACT

X-ray computed tomography (X-ray CT) is one of the ideal tools to characterize the pore structure and matrix inside building materials such as open foam mortars. This technique is very useful for studying. It does not destruct the internal structure of the material and can directly obtain the spatial distribution of the pores and solid phase. The key purpose of this study is to obtain significant information about pore structure with X-ray computed tomography and 3D image analysis. 3D characterization will be used as input for further modeling (acoustic emission, fluid flow behavior). We will focus on the characterization of multiscale open foam mortars in order to extract their structural parameters which are key information for the understanding of their acoustic properties. Acoustical properties are those that govern how materials respond to sound waves, which are what we perceive as sound [1]. Acoustical properties are important parameters because open foam mortars have some it in that they will all absorb, reflect or transmit sound striking them. They can be acquired by using acoustic emission, which is a non-destructive method for examining behavior of the materials under investigation. Although this technique is easy to implement, the information gained is only global.

In order to establish a link between the macroscopic acoustic properties of the open foam mortars and the 3D microscopic characteristics, high resolution X-ray tomography will be perform at the Ghent University Centre of X-Ray Tomography (UGCT). We will set up a standardized workflow for the characterization of the multiscale open foam mortar. Additionally, fluid flow parameters such as open porosity, resistivity/permeability as well as mechanical parameters will be determined in lab. The multiscale 3D pore network will be used as input for acoustics simulation and laboratory measurements will be done to validate the simulated results. We will compare different procedures for mesh extraction and use relevant parameters for simulation. The combination of acoustic emission and micro-tomography imaging provides us with a unique opportunity to study acoustic emission in relation to the microstructure of the materials.

GRAPHICS