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3D multi-scale reconstructed structure and transfer properties of porous material based by multiple approaches

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The micro and nano structures of porous material have strong influence on their transfer properties such as porosity, permeability, tortuosity and adsorption isotherm curves. In the construction and building material field, these properties are strongly related to hydro and thermal comfort, due to the fact that heat and mass transfer mechanisms are determined by the micro porous structure. In the present work, we aim to predict heat and mass transfer on such micro-nano structured materials, with a statistical quantification method that is extracted from morphology aspect. A large range of the pore size (from 20nm to 1mm) is covered and investigated by the multiple approaches, including FIB-SEM, X-Ray Tomography, and MIP (Mercury Intrusion Porosimetry). The 3D view of pore structures are obtained in concrete, as well as their size distribution, and pore zones. A reconstruct of 3D view of pore networks is extracted, with the spatial resolution of 20 nm/pixel. A global view of multiple testing methods and the corresponding size ranges are drawn to summarize the multi-scale approaches, for a potential further understanding of relationship between porous structure and thermal-hydro properties.

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