MK-GGBS FOAMS: RELATION BETWEEN MECHANICAL PROPERTIES AND MORPHOLOGICAL PARAMETERS

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This study aims to link the thermomechanical properties of blended metakaolin-ground granulated blast furnace slag (MK-GGBS) foam concrete (FC) to their morphological parameters. The AAM FC matrix is composed of MK, GGBS and an alkaline solution. The binder is composed of 62.5% of MK, 12.5% of GGBS and 25% of dry extract of alkaline solution. Water came from the alkaline solution and additional water to reach a water/binder ratio of 0.36. The AAM paste was aerated with different H_2O_2 contents (1, 1.5 and 2%) and stabilized with surfactant. The surfactant content ranged from 0.002 to 0.05 %. Lightweight AAMs were obtained with density from 264 to 480 kg/m^3. The analysis of the sectional view pictures revealed that AAMs FC porous structure is highly influenced by both H_2O_2 and surfactant contents. The H_2O_2 content modify the FC density while the surfactant content mostly modified the bubble distribution at a constant density.

The thermal conductivity of the AAMs FC mostly depended on the FC density and ranged between 0.084 and 0.139 W/(m.K). FC compressive strength ranged between 0.53 and 3.34 MPa. It mainly depended on H_2O_2 content. However, at constant density, FC compressive strength also depended on surfactant content. An optimized surfactant content (0.004%) maximizing FC compressive strength at constant density was found. The analysis of the cross view of the FC enables to do a quantitative analysis of the relation between FC composition (H_2O_2 and surfactant contents), porous structure and mechanical performances. However, a more precise quantification of the porous structure was required.

X-ray tomography was performed on several FC samples. The 3D geometries were rebuilt using a software (iMorph) in order to precisely characterize FC morphological parameters. As expected with the sectional view analysis, the FC porosity mostly depends on H_2O_2 content. Bubble size distribution was highly modified by the surfactant content. The analysis also revealed slight bubble shape anisotropy linked to their formation process. The cells had an ellipsoidal shape that can be described by 3 orthogonal axes a, b and c (a > b > c) in a 3D referential O,x,y,z. The bubble connectivity was also investigated and it significantly depended on both H_2O_2 and surfactant content. The X-ray tomography enabled to quantify the relation between FC composition and 3D morphology.

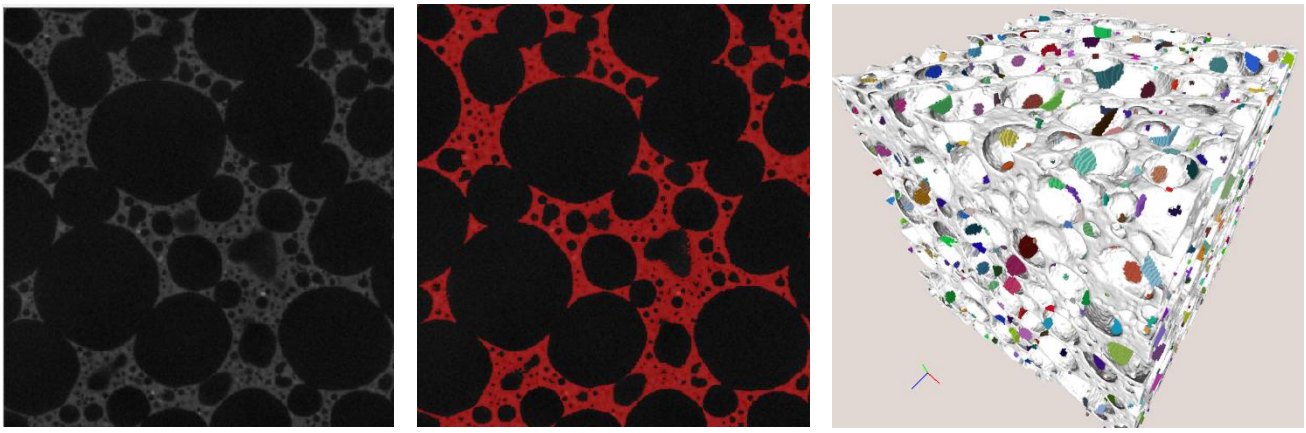

Figure 1. Raw image (left), binarized image (center) and segmentation of each throat on a 3D view (right).