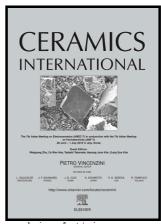
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ACCEPTED MANUSCRIPT

The impact of heat treatment on the microstructure of a clay-based ceramic and its

thermal and mechanical properties

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Abstract

This paper presents the results of an experimental study on the microstructure, the thermal and

the mechanical properties of a clay-based ceramic used in building applications. The X-ray

tomography analysis showed a layered microstructure of clay with 200µm sheets of porosity

after the extrusion process. The gas release from the dehydration, dehydroxylation and

decarbonation induced a 7vol% formation of porosity during the heat treatment of the clay-

based ceramic up to 850°C. The porosity increase and the development of metakaolin led to a

38% decrease in the thermal conductivity. On the other hand, the Young's modulus of the

clay-based ceramic was conserved due to the formation of smaller pores than the 200µm

sheets of porosity. The densification and the crystallization of amorphous phases also led to a

110% increase of the Young's modulus from 850°C to 1050°C. The Young's modulus of the

clay-based ceramic was only decreased by the $\beta \rightarrow \alpha$ quartz inversion of the cooling due to

sand addition. Hence, this study provided a useful insight into how the microstructure of fired

clay bricks can be specifically transformed by the porosity during the heat treatment to control

the thermal and mechanical properties.

Keywords: clay; ceramic; porosity; Young's modulus; thermal conductivity.

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