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The effects of firing temperature on the ceramic body morphology: experimental study by X-ray μ CT

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This work proposes a new analysis procedure aiming to study the effects of ceramic firing condition on the final product in order to distinguish the influences of the local production techniques. Particle packing, microstructure, porosity, as well as morphology of ceramic matrix are correlated to native material composition and firing temperature [1, 2]. These physical properties have been considered and investigated comparing the results obtained by Mercury Intrusion Porosimetry (MIP), Scanning Electron Microscope (SEM) and X-ray micro Computed Tomography (X-ray μ CT).

Recent measurements on archaeological and art materials by the innovative and non-destructive X-ray μ CT method show promising results in Cultural Heritage field. This technique offers the advantages to provide information by images of the inner part of the object and to preserve its integrity [3, 4, 5].

In this preliminary study home-made ceramic samples obtained from calcite-rich clay and subjected to different firing temperatures (in the 400°C-1000°C range) have been analyzed. SEM, MIP and X-ray μ CT have provided complementary information regarding the effects of firing condition on physical properties and microstructure of ceramic mixture. SEM images show a more compact and vitrified morphology in samples fired at 900°C and 1000°C, in according to the melting temperatures of minerals.

The results obtained by MIP, regarding the open porosity, show cumulative volume increase with firing temperature due to the presence of carbonate-rich clay which promotes high porosity over 600°C [6]. A more complete evaluation of the total porosity (open and close) is given by X-ray μ CT measurements. The imaging elaboration of X-ray μ CT results allowed to evaluate and calculate total porosity, pore size distribution and shape, Feret's diameter and tortuosity.

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