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Autoclaved pozolanic ceramic tile characterization

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Abstract – A ceramic tile was produced using autoclaving instead of sinterization process, with temperature of 200°C during two different times: one and two hours. The autoclave treatment time influenced the formation of hydrated phases and porosity of the ceramic material, since the samples with one hour of autoclave treatment presented higher flexural strength. Thermal analysis and X-ray diffraction showed similar results to the samples with different treatment times. The microscopy and mercury intrusion porosimetry results evidenced some porosity differences between the samples, that can be associated to the different mechanical strengths founded.

Process is a main variable for the performance of ceramics devices, and the environmental impact of the process has been noticed even more. It is known that the autoclaving process for pozolanes has energy consumption lower than the sinterization, to reach the same mechanical performances [1]. This work introduces the influence of time under autoclaving treatment on the hydrated phase formation and porosity for pozolanics tiles.

The ceramic is made of lime, bentonite, quartz sand and water, using different times of autoclave treatment and same composition. The material produced has environmental relevance due to its employment of lime from oyster shell waste, an abundant residue in Florianópolis bay. A previous study investigated different mixtures [2]. The composition which showed the best mechanical behavior as ceramic tile was chosen for this work. Some samples received autoclave treatment at 200ºC for 1 hour, and some samples stayed for 2 hours into autoclave.

Scanning electronic microscopy (SEM), simultaneous thermal analysis (STA), mercury intrusion porosimetry (MIP) and X-ray diffraction (XRD) were used for the characterization. XRD and STA results did not show significant differences between the ceramics tiles with autoclave treatment duration, indicating that the phases produced were approximately the same. MEV observations and MIP measurements (Fig. 1) show a reduction of the average pore size for the samples with 2 hours of treatment, due to a denser calcium-silicate structure.

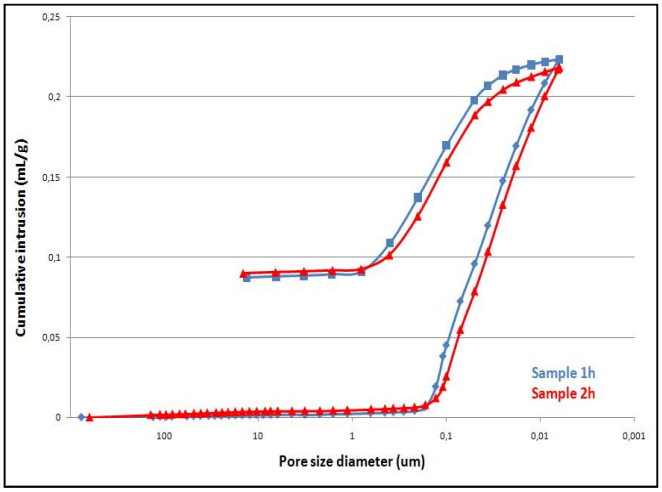

Figure 1: Mercury intrusion porosimetry for samples with 1 (blue) and 2 (red) hours of autoclaving treatment.

References

[1] E. H. Ishida. Channelling the forces of nature – human and earth conscious materials may create new waves. VIII World congress on ceramic tile quality, Vol. I, p. 3-23, 2004.
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