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MODELLING AND NUMERICAL SIMULATION OF MASS TRANSFER AND MECHANICAL PROCESSES AT CERAMIC WARE IN INDUSTRIAL DRYERS

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An algorithm for efficiency improvement of industrial drying processes of ceramic ware with complicated geometries is developed. It is based on mathematical modelling and numerical simulation of the transient moisture content fields and subsequent mechanical processes in three dimensional ceramic bodies. The models allow variations of the drying conditions and time duration of the process in order to choice the most efficient regime at existing or design dryers. The possibility for energy saving is estimated by thermal balances of the drying installations.

The proposed models are applied for finite element analysis of wet bricks behaviour in continuous working drying installation. The shrinkage mode, modulus of elasticity, Poisson ratio, modulus of rupture, effective mass transfer coefficient and critical moisture content are determined by experimental tests of the material. They are used to simulate numerically the moisture, stress and strain fields in the 3D geometry of the ceramic bodies at the existing drying regime. The mathematical models are validated on the base of in situ measurements of parameters of the drying installations.

Ways for estimation of the potential for energy savings on the base of the developed algorithm are discussed.

REFERENCES

[1] A. Sander, D. Skansi, N. Bolf, Heat and mass transfer models in convection drying of clay slabs. *Ceramics International* 29 (6): 641-653, 2003.
[2] M. K. Teixeira de Brito, D. B. Teixeira de Almeida, A.G. Barbosa de Lima, V.A. Barbosa de Oliveira, Heat and mass transfer during drying of clay ceramic materials: a three-dimensional analytical study. DOI 10.4028 /www.scientific.net/ DF.10.93, 2017.
[3] M. Heydari1, K. Khalili, S. Y. Ahmadi-Brooghani, Simulation of stresses induced by heat and mass transfer in drying process of clay-like material, *JCAMECH*, Vol. 48, No. 2, 171-184, 2017.