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ADVANCED CERAMICS AND APPLICATION III
New Frontiers in Multifunctional Material Science and Processing

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Institute of Chemistry Technology and Metallurgy
Institute of Physics
Institute for Technology of Nuclear and Other Raw Mineral Materials
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Advanced Optimization of Heavy Clay Products Quality by Using Artificial Neural Network Model

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The effects of firing temperature (800–1100°C), chemical composition (expressed in terms of the content of major oxides - SiO_2, Al_2O_3, Fe_2O_3, CaO, MgO, Na_2O, K_2O, MnO and TiO_2), as well as several shape formats of laboratory brick samples on the final product quality were investigated. Prediction of the final laboratory products parameters was evaluated by second order polynomial regression models (SOPs) and artificial neural networks (ANNs), and afterwards both models were compared to one another and to experimental results. . Observed parameters of fired products that were determined in this study were: compressive strength (*CS*), water absorption (*WA*), firing shrinkage (*FS*), weight loss during firing (*WLF*) and volume mass of cubes (*VMC*). SOPs showed high r^2 values (0.897 - 0.913 for compressive strength models, 0.942-0.962 for water absorption, 0.928 for firing shrinkage, 0.988-0.991 for water loss during firing and 0.941 for volume mass of cubes models). ANN model, coupled with sensitivity analysis, was obtained with high prediction accuracy: 0.866–0.939 for compressive strength models, 0.954–0.974 for water absorption, 0.882 for firing shrinkage, 0.982-0.988 for water loss during firing and 0.920 for volume mass of cubes models. The optimal samples chemical composition and firing temperature were chosen depending on a final usage of the raw material in heavy clay brick industry.

Keywords: Heavy clay products; Prediction; Optimization