

Optimization of the Energy Consumption of the Pottery Kilns by the Use of Heat Exchanger as Recovery System and Modeling of Heat Transfer by Conduction Through the Walls of the Furnace

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Abstract : Morocco is one of the few countries that have kept their traditional crafts, despite the competition of modern industry and its impact on manual labor. Therefore the optimization of energy consumption becomes an obligation and this is the purpose of this document. In this work we present some characteristics of the furnace studied, its operating principle and the experimental measurements of the evolutions of the temperatures inside and outside the walls of the furnace, values which will be used later in the calculation of its thermal losses. In order to determine the major source of the thermal losses of the furnace we have established the heat balance of the furnace. The energy consumed, the useful energy and the thermal losses through the walls and the chimney of the furnace are calculated thanks to the experimental measurements which we realized for several firings. The results show that the energy consumption of this type of furnace is very high and that the main source of energy loss is mainly due to the heat losses of the combustion gases that escape from the furnace by the chimney while the losses through the walls are relatively small. It has opted for energy recovery as a solution where we can recover some of the heat lost through the use of a heat exchanger system using a double tube introduced into the flue gas exhaust stack compartment. The study on the heat recovery system is presented and the heat balance inside the exchanger is established. In this paper we also present the numerical modeling of heat transfer by conduction through the walls of the furnace. A numerical model has been established based on the finite volume method and the double scan method. It makes it possible to determine the temperature profile of the furnace and thus to calculate the thermal losses of its walls and to deduce the thermal losses due to the combustion gases. Validation of the model is done using the experimental measurements carried out on the furnace. The results obtained in this work, relating to the energy consumed during the operation of the furnace are important and are part of the energy efficiency framework that has become a key element in global energy policies. It is the fastest and cheapest way to solve energy, environmental and economic security problems.

Keywords : energy consumption, energy recovery, modeling, energy efficiency

Conference Title : ICESTEM 2023 : International Conference on Energy Saving Technologies and Energy Management

Conference Location : Rome, Italy

Conference Dates : September 11-12, 2023