

The Study of Heat and Mass Transfer for Ferrous Materials' Filtration Drying

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Abstract : Drying is a complex technologic, thermal and energy process. Energy cost of drying processes in many cases is the most costly stage of production, and can be over 50% of total costs. As we know, in Ukraine over 85% of Portland cement is produced moist, and the finished product energy costs make up to almost 60%. During the wet cement production, energy costs make up over 5500 kJ / kg of clinker, while during the dry only 3100 kJ / kg, that is, switching to a dry Portland cement will allow result into double cutting energy costs. Therefore, to study raw materials drying process in the manufacture of Portland cement is very actual task. The fine ferrous materials drying (small pyrites, red mud, clay Kyoko) is recommended to do by filtration method, that is one of the most intense. The essence of filtration method drying lies in heat agent filtering through a stationary layer of wet material, which is located on the perforated partition, in the "layer-dispersed material - perforated partition." For the optimum drying purposes, it is necessary to establish the dependence of pressure loss in the layer of dispersed material, and the values of heat and mass transfer, depending on the speed of the gas flow filtering. In our research, the experimentally determined pressure loss in the layer of dispersed material was generalized based on dimensionless complexes in the form and coefficients of heat exchange. We also determined the relation between the coefficients of mass and heat transfer. As a result of theoretic and experimental investigations, it was possible to develop a methodology for calculating the optimal parameters for the thermal agent and the main parameters for the filtration drying installation. The comparison of calculated by known operating expenses methods for the process of small pyrites drying in a rotating drum and filtration method shows to save up to 618 kWh per 1,000 kg of dry material and 700 kWh during filtration drying clay.

Keywords : drying, cement, heat and mass transfer, filtration method

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