EXPERIENCE IN OPERATING A THREE-ZONE FLUIDIZED-BED LIME KILN

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A three-zone lime kiln at the Makeevka Metallurgical Plant is briefly described. The principal technical and economic characteristics of the kiln are noted.

Since 7 January 1967, a three-zone fluidized-bed lime kiln has been operating at the Makeevka plant. The kiln consists of a refractory-lined shaft 2750 mm in diameter, the working space is 11 000 mm high.

The refractory hearth of the kiln is of arched construction, the wedges used to form the arch being leveled off with ordinary chamotte. This is topped with specially made bricks of kaolin chamotte measuring 250 × 250 mm. The bricks have a single opening to receive a ceramic sleeve with an inside diameter of 58 mm. The interval between openings (and hence the distance between arches) is 250 mm.

The return-flow system is of the valve type with a barrier layer. The 200-mm diameter return flow pipe has a compensator. The dimension of the outlet nozzle is 165 mm. The return flow is regulated by a flat valve.

The burners are tubes 50 mm in diameter and 220 mm high, in which a 14-mm gas tube with lateral openings for the jet mixing of gas and air is inserted. The kiln has 86 burners at intervals of 220 mm. Air and gas are supplied to groups of 3–8 burners. The supply system is fitted with valves for adjusting the distribution of gas and air.

Muffle-type burners are disposed at three points around the periphery of the kiln for the incomplete combustion of the prepared gas-air mixture.

The discharger takes the form of a water seal with an auxiliary fluidized bed, the object of which is to "make" pressure in order to ensure that the lime is discharged without expelling combustion products. The lime is fluidized by cold air from the common air header.

The kiln is equipped with monitoring and measuring instruments and automatic controls. The temperature in the calcination zone is kept constant to within ±10° C by an automatic BR-2K regulator acting on the gas flow rate.

The scrubbing system consists of two lined cyclones (2200 mm outside diameter) and a single 2.5-m wet scrubber.

The operating characteristics of the three-zone fluidized-bed lime kiln are as follows: output per work day 191 tons/day; down time (including cooling and heating) 7.7%; entrainment losses 7.5%; flow rate of natural gas (at 9000 kcal/m^3) 180 m^3/ton; power consumption 41 kW · hr/ton; temperature of discharged lime 850° C; temperature in calcination zone 950–1000° C; temperature of waste gases 550–600° C; specific volume and hearth loads 2.94 ton/m^3 per day and 32.3 ton/m^2 per day, respectively.

The individual quality characteristics of the lime vary within the following limits determined by the calcining conditions: degree of calcination 93.5–98.0%; slaking time 1–6 min; paste yield 2–3l/kg.

A fractional analysis of the lime showed that the fractions ≥7 mm are chiefly responsible for incomplete calcination.

Four-zone kilns with capacities of 300, 400, and 600 tons per day are being planned.

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