THERMAL CONDUCTIVITY OF REFRACTORY BRICK MATERIALS

BY

JOHN NJOROGE KIMANI

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This thesis is my original work and has not been presented for a degree in any other University.

JOHN NJOROGE KIMANI

This thesis has been submitted for examination with our approval as University Supervisors.

DR. W.H. DRAKE
Department of Physics,
University of Nairobi.

DR. ERNEST SARHENE
Department of Physics,
University of Nairobi.

ABSTRACT:

Thermal conductivities of refractory bricks made from the materials; fireclay, kaolin, siaya clay and Kisii soap stone have been measured. The thermal conductivities of the bricks in dry air at atmospheric pressure were determined at different porosity percentages and as a function of temperature from room temperature to about 800°C. The effects of particle size distribution, chemical composition, grain structure, firing shrinkage, weight loss on firing, density, casting pressure and firing temperature for each material on the thermal conductivity values were investigated. The thermal conductivity values were determined by an unsteady state method, the transient hot wire method of comparison, which is based on the model of heating a cylinder of a perfect conductor sorrounded by an infinite amount of a reference material on one side and on the other side the material whose thermal conductivity is being measured.

The porosities of the prepared bricks ranged; from 23.3 to 56.0 per cent for fireclay, from 21.1 to 56.7 per cent for kaolin and from 21.3 to 57.6 per cent for Siaya clay.

The thermal conductivities of the refractory bricks increased with decreasing percentage porosity. For all the brick materials studied, the thermal conductivity values measured increased with increasing temperature. The rate of increase of these thermal conductivity values was higher at low temperatures below 500°C and and lower at higher temperatures above 500°C.

The results obtained from experiment were compared to those predicted by theoretical models of heat transfer in porous materials. The model of Imura et al. gave the best explanation of the variations.

These results are useful to designers who will require to calculate heat losses in refractory material applications.