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PAPERS

DESCRIPTION OF HOT MODULUS OF RUPTURE AND HOT CRUSHING STRENGTH TESTS AND DISCUSSION OF RESULTS*

By E. B. Hunt and R. S. Bradley

Abstract

The equipment and test procedures used to make modulus of rupture and crushing tests on refractory specimens at high temperatures are described and illustrated. The results of the tests at various temperatures are given for several types of fire-clay refractories and insulating firebrick.

I. Introduction

The tests ordinarily used to determine the strength of refractory materials are crushing strength, modulus of rupture at room temperature, and compression under load at high temperatures. Standard procedures for each of these tests, which have been accepted by the A.S.T.M., are designated as Methods of Tests C133-39 and C16-39T, respectively.

Test results are given frequently for crushing strength or modulus of rupture on samples which have been subjected to a prescribed heat treatment and then allowed to return to room temperature before testing. Although such results are interesting and valuable information has been obtained from them, they do not give any information as to the strength of these refractory materials while they were at this elevated temperature. Such information would be useful in the design of all high-temperature equipment, especially in the design of refractory shapes used in the construction of suspended arches and walls. This problem was considered to be of sufficient importance to justify the design of special equipment and the development of a test procedure.

II. Description of Equipment

(1) Modulus of Rupture

The furnace and test machine (see Figs. 1 and 2) were designed to withstand a total load of 24,000 lb. on either of the two test specimens at temperatures up to 2900°F. The steel frame supporting the hydraulic jack is structurally independent of the furnace, and the total load applied to the test specimens is taken by this frame, which is above, below, and on each side of the furnace. Because this steel frame passes under the center bottom of the furnace, it is necessary to have outlets on each side for the furnace gases. The furnace is designed to permit the control of the temperature independently on each of the two test specimens, and it is fired with open-type gas burners (using 1000 B.t.u. natural gas at 4 lb. of pressure and air at 1 lb. of pressure).

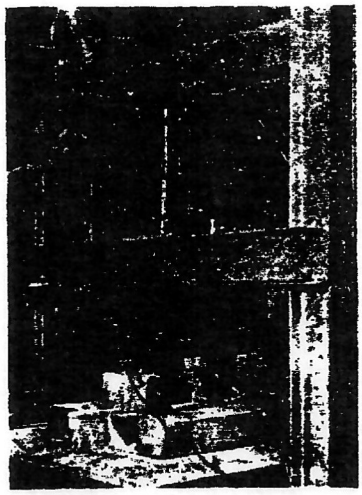


Fig. 1.

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