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Refractoriness under load / creep in compression

Introduction

Refractoriness under load (RUL, according to ISO 1893) is a measure of the deformation behaviour of refractory ceramic products exposed to a constant load and increasing temperature. According to the European standard EN993-9, a fixed compressive stress of 0.2 MPa is loaded on the test piece during the heating-up and dwell time. The temperature varieties in which the softening occurs is not identical with the melting range of the pure raw material. Creep in compression (CIC, according to ISO 3187) refers to the percent of shrinkage of a refractory specimen under a continuous load and exposed to a constant high temperature over a long period of time [1].

Sample Preparation

The same test-piece dimensions of 50 mm in diameter and 50 mm in height are used for both the RUL and the CIC tests. For the high-precision differential measuring system for determination of the deformation, the cylindrical test piece has a co-axial bore of 12.5 mm. Selection and application of the load on the test piece are reproducible and independent of the deformation through use of the hood-type furnace with counterweights [2].

Test Procedure

Figure 1 demonstrates a schematic diagram of the device for high temperature refractoriness under load.

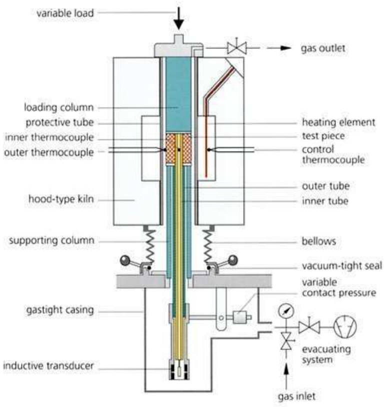

Figure 1 – RUL/CIC scheme setup [1].

An electrical furnace is introduced and prepared with a protective tube. Two thermocouples are used to measure the temperatures, one of which is located near the specimen to monitor its temperature and the other one is placed close to heating elements to control the furnace temperature [2,3]. The loading is recognised by a single spindle connected to a load cell. Water-cooled grippers are placed at the cold ends of corundum push rods to protect the metal components.

Expected Result

The temperatures, at which the specimens start to deform as drop and eventually fail, are then reported. In practice it is common to draw a graph to show the rate of dropping of the material with temperature rise. At 960°C the test piece reaches its maximum expansion. Deformations of 0.5%, 1.0% and 2.0% have been achieved at 1210°C (T05), 1240°C (T1), and 1270°C (T2) respectively [4].

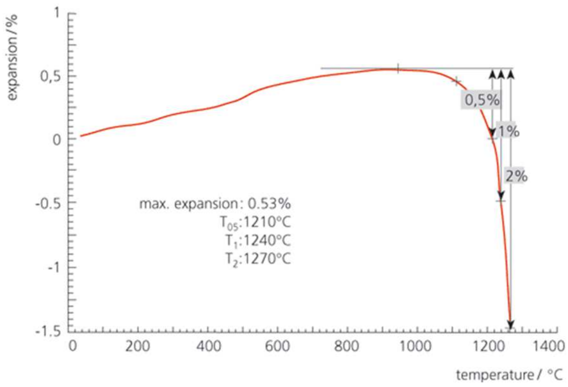

Figure 2 – Expected results [4].

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