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Uniaxial compressive creep test

Introduction

The uniaxial compressive creep test allows the investigation of creep behaviour at high temperatures and under compressive stress. The device has been developed to overcome the disadvantages of standard testing approaches like RUL (refractoriness under load) and CIC (creep in compression). Contrary to those approaches, the current device can apply service related loads after reaching the target temperature; the starting point of creep can be well recorded, and accurate deformation can be measured [1].

Sample Preparation

Cylindrical specimens with 35mm diameter and 70mm height are drilled out of refractory bricks and inserted in the test device (Figure 1). A height to diameter ratio of 2 reduces the impact of friction between the bearing and the specimen on the measured area. Additionally, an intermediate bearing component constructed of a creep resistant material is used in order to protect the specimen and upper piston.

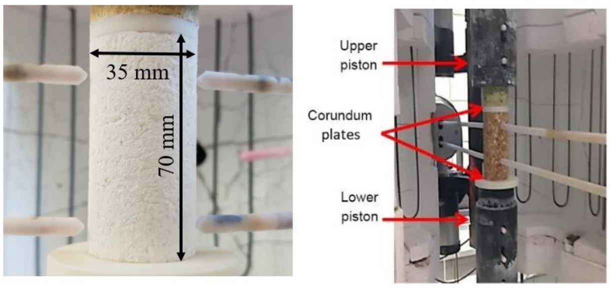

Figure 1– Sample's Geometry and installation.

Testing Device and Procedure

A schematic of the testing device is shown in Figure 2. The alignment of the sample is confirmed at room temperature by performing an elastic test and checking the extensometers readings on both sides of the specimen. Heating of the specimen with 10°C/min to the target temperature is the next step, and 1 hour holding time is considered for homogenization of temperature in the specimen. Then, the desired load is applied and two extensometers measure the displacement on the surface of the sample (sensor arm distance: 50 mm).

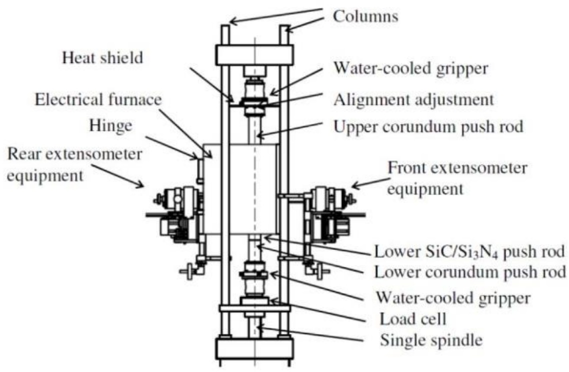

Figure 2– Compressive creep test device.

Expected Results

The diagram below shows a typical result of a uniaxial compressive creep test (Figure 3). After obtaining strain/time data, the creep law parameters are evaluated by an inverse evaluation method.

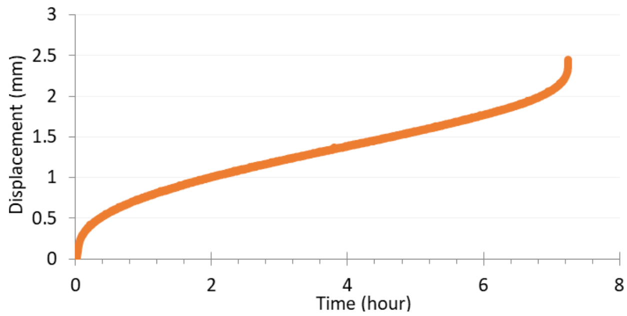

Figure 3 – Displacement/time curve.

Acknowledgement

This work was supported by the funding scheme of the European Commission, Marie Skłodowska-Curie Actions Innovative Training Networks in the frame of the project ATHOR - Advanced THermomechanical multiscale mOdelling of Refractory linings 764987 Grant.

References

[1] S. Jin, H. Harmuth, D. Gruber. Compressive creep testing of refractories at elevated loads - Device, material law and evaluation techniques. Journal of the European Ceramic Society 34(15) (2014) 4037-4042.

European Commission | Horizon 2020 European Union funding for Research & Innovation