Wedge Splitting Test

Introduction
To consider the mode I fracture in thermo-mechanical simulation of refractories, characterization of the fracture energy and the tensile strength of the material is necessary. The Wedge Splitting Test (WST) is a suitable method to characterize the mode I fracture phenomenon in refractory materials, which enables stable crack propagation for relatively large specimen dimensions [1,2].

Specimen Dimensions and Testing Procedure
The new testing device at Chair of Ceramics (MUL) for WST, allows accurate fracture mechanical characterization of refractories at room and high temperatures up to 1500 °C using laser speckle extensometers on the back and the front side of the specimen. Reducing conditions can also be provided for carbon containing refractories [3]. Figure 1 and Figure 2 show the specimen’s dimensions and a schematic of configuration for testing.

Figure 1– Specimen’s dimensions.

Figure 2– Schematic of specimen in WST [3].

The vertical displacement is applied with the rate 0.5 mm/min, and the load is measured using a load cell. The horizontal displacement is measured directly on the back and the front side of the specimen via laser speckle extensometer.

Expected Results
Results are received in the form of load-displacement diagrams (Figure 3), from which the following parameters can be directly calculated: specific fracture energy \( G'_f \) and nominal notch tensile strength \( \sigma_{NT} \):

\[
G'_f = \frac{1}{A} \int F_h dx_h
\]

\[
\sigma_{NT} = \frac{F_{h,max}}{bh} \left( 1 + \frac{6y}{h} \right)
\]

Where, \( F_h \) and \( x_h \) are the horizontal force and displacement, \( A \) denotes the ligament area (shaded area in Figure 1), \( b \) and \( h \) are the width and the height of the ligament area, and \( y \) is the vertical distance between the horizontal load point and the centre of \( A \).

Later on, with the means of the simulation and inverse evaluation algorithms, total fracture energy and tensile strength can be evaluated from the experimental results.

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References