

Key areas of work

- ◆ Thermo-mechanical testing of ceramic matrix composites at temperatures up to 2200 K
- ◆ Characterization of the mechanical behaviour of monolithic ceramic, functional ceramic and porous ceramic
- ◆ Development of new testing procedures in mechanical testing
- ◆ Fiber reinforced light metals for aero engines
- ◆ Cooperation in the development of technical rules and standards (DIN NMP 291, CEN/TC 184)
- ◆ Customized mechanical testing

BAM, division 5.2 (old V.2) is approved by DGA Deutsche Gesellschaft für Akkreditierung mbH according to DIN EN ISO/IEC 17025:2005 as an accredited testing laboratory.



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Composite Materials

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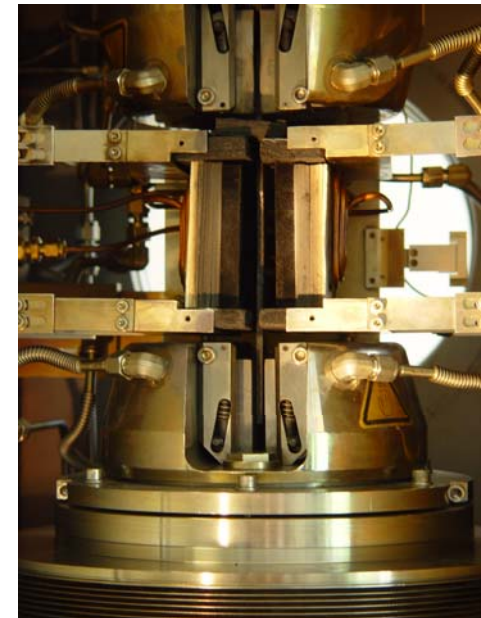
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Federal Institute for Materials Research and Testing

**Tensile Tests at High Temperatures up to
1900°C**



**Working Group
„Composite Materials“**

Basic principles

The tensile test exhibits a homogeneous stress distribution and a pure uniaxial stress state and, therefore, provides the clearest procedure to determine the tensile strength.

A tensile specimen is loaded in axial direction till fracture. During testing the applied load and displacement of a gage length of a tensile specimen are recorded. This load-displacement-curve is converted to a stress-strain curve in consideration of the cross section of the specimen and the gage length before loading.

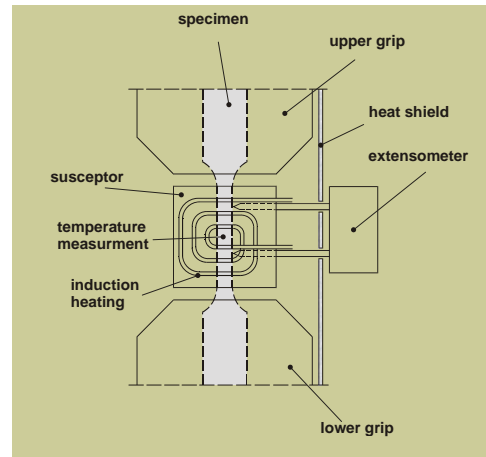
Typical tensile properties such as tensile strength, stiffness and elastic/plastic deformation behaviour can be obtained from the results of the tensile test.



Tensile Testing Facility for Temperatures up to 1900 °C

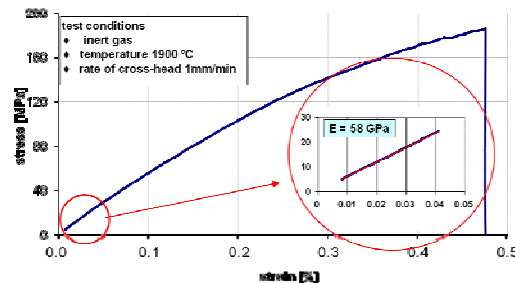
Procedure

The testing device was conceived for the determination of mechanical properties of ceramic composite materials.



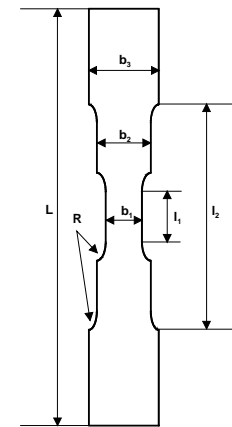
Schematic representation of the experimental setup

Tests can be carried out in vacuum and in inert gas up to 1900 °C, and in air up to 1600 °C . The sample is heated by using induction heating combined with susceptor plates for insulating materials.



Stress-strain curve of C/C-Composite specimen at 1900 °C; determination of the pseudo Young's Modulus

Typical sample geometry



Flat sample
(rectangular cross section)

$$L = 210 \pm 0.5 \text{ mm}$$

$$l_1 = 30 \pm 0.2 \text{ mm}$$

$$l_2 = 110 \pm 0.2 \text{ mm}$$

$$b_1 = 15 \pm 0.1 \text{ mm}$$

$$b_2 = 20 \pm 0.2 \text{ mm}$$

$$b_3 = 25 \pm 0.2 \text{ mm}$$

$$R = 30 \pm 2 \text{ mm}$$

(Minimum length of sample : 180 mm)

Standards

◆ DIN EN 1893

Advanced technical ceramics, ceramic composites - tensile strength testing at high temperature in air at atmospheric pressure

◆ DIN EN 1892

Advanced technical ceramics, ceramic composites—tensile strength testing at high temperature under inert atmosphere

◆ ASTM C 1359

Continuous fiber-reinforced advanced ceramics, tensile strength testing at elevated temperatures