Elastotron 2000

Key words

Elastic modulus, damping behaviour, high temperature test, resonant beam technique, metallic materials, alloys, monolithic ceramics

Fields of application

Elastotron 2000 was developed to determine the elastic moduli and the damping behaviour of materials with linear-elastic behaviour up to temperatures of 1900 °C.

Methodology and instrumentation

The principle function is the sonic resonance method. A sample is excited to bending vibrations using a piezoelectric sensor (transmitter). A second piezoelectric sensor (receiver) detects the corresponding response of the specimen. The signal is amplified and transmitted to a network analyser.

The specimen is suspended between two embedded graphite heating elements of a furnace within a vacuum chamber.

The resonant peaks and the elastic modulus are detected and determined by specially developed software.

The elastic modulus value depends on the frequency of the peaks, geometry and density of the specimen.

Items tested

Specimen with prismatic or round cross section from metals, alloys, composite materials, monolithic ceramics

Quantities / characteristics tested

Elastic modulus (>10 GPa) , Shear-modulus, Poisson's ratio (calculated)

Uncertainty / reliability of results

Relative uncertainty for a 95 % confidence level: Elastic-modulus 2 %; Shear-modulus 5 %

Qualification and quality assurance

Only test system of this type in Germany, comparable system only at TU Vienna. Unrivalled in the determination of temperature dependent elastic moduli at high temperature levels. Extensive experience and numerous publications, good results in international round-robin tests, participation in standardisation of test methods.

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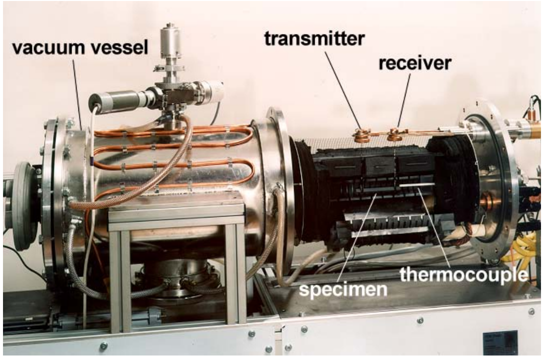
Further information

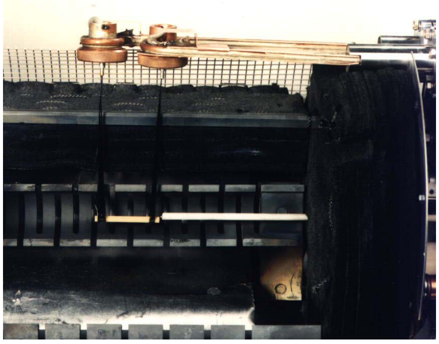
Determination of the dynamic elastic modulus up to temperatures of 1900 °C in the Elastotron 2000 with the resonance method



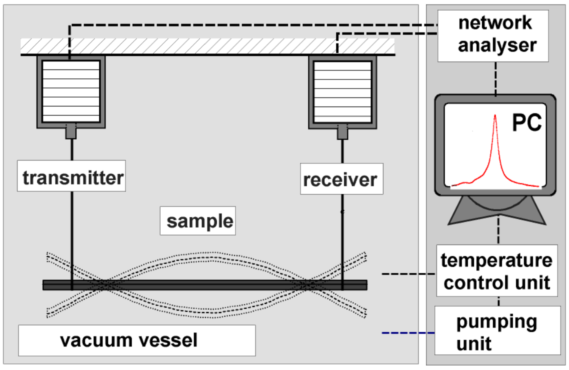
The determination of the dynamic Young's modulus with the resonance method using the Elastotron 2000 is a time-saving and competitive method to detect the temperature-dependence of the elastic modulus using only one specimen.

This testing device is equipped with a carbon felt insulated furnace with graphite heating elements embedded in a vacuum chamber. The equipment can be used for tests up to 1900 °C depending on the thermal stability and the damping behaviour of the test material.

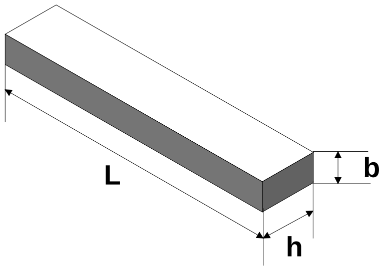
A sample with a rectangular or round cross section is suspended between a piezoelectric transmitter and receiver using carbon fibre threads. A sinusoidal signal from the transmitter vibrates the specimen with constant amplitude. A piezoelectric detector (receiver) picks up the resulting oscillations. The resonance spectrum is obtained by continuously varying the excitation frequency between 0.1 kHz and 100 kHz.



With especially developed software the elastic moduli of anisotropic materials can be determined.



An important pre-condition for a good measurement is the compliance to the tolerances of the specimen's dimensions, especially the plane parallelism.



Literature

- **DIN V ENV 843-2**
  Determination of Young's modulus, shear modulus and Poisson's ratio of monolithic ceramics
- **ASTM E 1875**
  Determination of the dynamic elastic properties by sonic resonance
- **ASTM C 623**
  Dynamic elastic properties for glass and glass-ceramics by resonance
- **ASTM C1198**
  Dynamic elastic properties for advanced ceramics by sonic resonance

Example for dimension
The mass m of specimen should not exceed 50 g.

DIN
- Prismatic bar with rectangular cross section
- L/h > 10
- L/b > 10
- plane parallelism: h/100, b/100, L/200

ASTM
- Prismatic bar with rectangular cross section
- 10 < L/(h * b) < 25
- m > 5 g
- plane parallelism: 0.01 mm or ± 0.1 %