TLB
Technologie-Lizenz-Büro
der Baden-Württembergischen
Hochschulen GmbH

Force Measurement in Autoclaves: Reliable, Robust System for Strain Gauge use without Media Contact

Background

In order to take later usage conditions into account when testing materials, or also to simulate material aging under load, material testing is often carried out in temperature-controlled autoclaves under certain media and high pressure. The aggressive operating conditions in such autoclaves require either insensitivity of the measuring sensors to temperatures and aggressive media or their installation outside the container.

Problem

A very reliable and comparably simple method of force measurement is the use of so-called strain gages. This is an electrical resistance which is mostly attached or adhered directly to the sample, thus recording its change of shape on the surface area. The length change causes an alteration in the electrical resistance of the strain gage which provides very precise conclusions to be drawn on the arising tensions in the sample (through elongation or contraction), even with dynamic loads. However, the use of this technology in autoclaves is very time-consuming. Depending on the medium, its use can even be impossible or very prone to errors. A direct measurement via load cells is also unreliable as the force measurement is carried out outside the autoclave and friction occurs on the seals of the autoclave. This friction force falsifies the measurement as there is a discrepancy between the measured force and the actual force applied to the sample.

Solution

For the first time, this measuring system developed at the University of Stuttgart uncouples the media space and measurement space from each other by mounting the sensor in an especially sealed deformation element. A hollow cylinder acts as sample holder and protrudes with one end into the media space. On its inside wall, strain gauges and other sensors, for example for temperature, can be positioned as desired and attached without any problems. The outer wall serves as sealing surface. In this way, the cylinder serves as both sample mount and as force measurement element. Due to its simplicity and compactness, the system is very robust against bending load as well temperature and pressure fluctuations.

For the first time, it enables a reliable force measurement in the direct force flow and close to the sample, even in the most demanding of scenarios. This includes, for example, the calculation of vibration resistance of a sample under high hydrogen pressure and in extreme temperatures. The structure and positioning of the sensors can be optimized depending on requirements, for example using several narrow boreholes in the cylinder or by attaching additional insulation and guides.

Advantages

Contact
Dipl.-Ing. Emmerich Somlo
TLB GmbH
Ettlinger Straße 25
76137 Karlsruhe | Germany
Phone +49 721-79004-0
somlo@tlb.de | www.tlb.de

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Service
Technologie-Lizenz-Büro GmbH has been entrusted with the exploitation of this technology and assists companies in obtaining licenses.

- Use of strain gage without contact to media
- No cable routing
- No corrosion wear
- No imprecision of measurement caused by friction
- Measuring unit is robust against bending, temperature and pressure fluctuations
- Reliable in extreme temperatures
- Structure suitable for aggressive media and high pressure

Fields of application

Force measurement for material testing in autoclaves or under difficult conditions