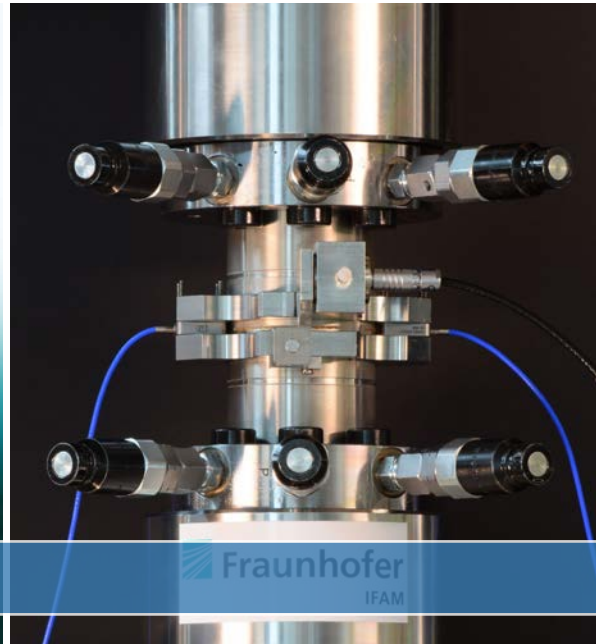




Biaxial inspection of adhesive bonds

<https://www.sciencedirect.com/science/article/pii/S0143749618300538?via%3Dihub>

In order to determine the shear and tensile strength of high strength and high stiffness structural adhesives, amongst other things a so-called double tube sample is used. In this case, two thin-walled tube joining parts are connected to the front side of the adhesive to be tested. Using a hydraulic tensioning device, this double tube sample is clamped in the load path of the testing machine. The layer thickness of the adhesive bond is typically only a few tenths of a millimeter. The sample is now loaded by tension (axial displacement) and/or torsion. Subsequently, the relative displacements of the tube joining parts resulting from these movements are measured as a function of the applied force and the torsional moment. Due to these physical loads, displacements are caused which amount to only a few micrometers until the adhesive bond breaks. The measured displacements to determine the stiffness of the adhesive are only in the submicrometer range.

Measuring these very small displacements requires a very accurate and stable measuring system. The test set-up therefore includes three Micro-Epsilon capacitive sensors, which are connected via a capaNCDT 6500 capacitive controller with DL6530 demodulator module. Using a special holder, the sensors are attached directly to the tube joining parts of the double tube sample. Two flat sensors with 2 mm measuring range measure the displacement in the axial direction and a cylindrical sensor measures the displacement by torsion. Due to the non-contact measuring technique used, it is easy to decouple axial displacement components and the torsion-induced displacement. The sensor signals are fed via the BNC analog output of the measuring system into customer-specific test software, which also enables control of the test system.

Requirements for the measurement system

- Non-contact measurement
- Distortions at sub-micrometer accuracies can be detected reliably
- Long-term stability of the measured values
- Synchronization of sensors

Ambient conditions

- Test bench in the laboratory
- Constant room temperature
- Clean environment

System design

- Controller: DT6500 with DL6530 demodulator
- Sensors: 2 x CSH2FL-CRm2,8 with 2 mm MR
1 x CS2 with 2 mm MR
- Sensor adapter tailor-made by the customer

Advantages

- Non-contact, without clearance
- Easy and reliable decoupling of components from axial displacement and torsion
- Extremely high resolution and precision
- Low-noise and long-term stable
- Multi-channel system (synchronous)
- Exchangeability of sensor heads for new measurement tasks
- Analog output with BNC connector