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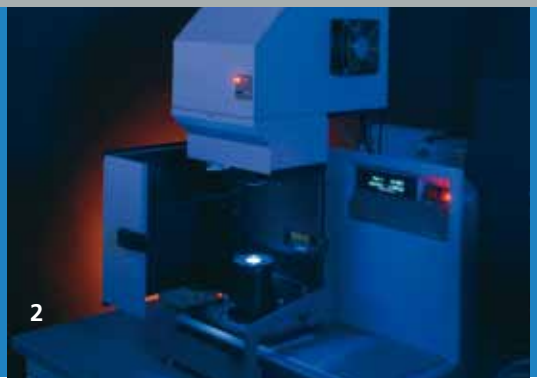
FRAUNHOFER-INSTITUT FÜR FERTIGUNGSTECHNIK UND ANGEWANDTE MATERIALFORSCHUNG IFAM


1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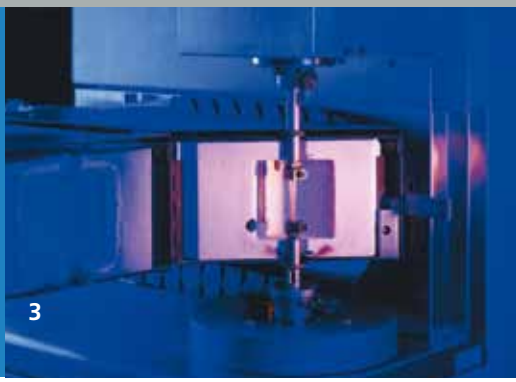
3

1 *DSC with autosampler.*
2 *Photo-DSC.*
3 *DMA; Torsion.*

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THERMAL ANALYSIS

Thermal Analysis

Thermal analysis techniques provide fundamental information about the processing behavior and usage properties of adhesives and sealants. These techniques measure specific physical and chemical properties of a substance, a mixture of substances, or a reaction mixture as a function of temperature or time.

Portfolio of thermal analysis techniques at Fraunhofer IFAM

Differential scanning calorimetry (DSC) – heat-flux and power-compensation technology – determine the heat flow and can be used to measure :

- Temperatures and enthalpies of physical changes such as melting and crystallization
- Temperatures and enthalpies of chemical reactions such as crosslinking and curing
- Glass transitions
- Specific heat capacities

Thermogravimetric analysis (TGA) coupled with mass spectroscopy (MS) measures mass changes and can be used to determine:

- Thermal stability
- Volatile components
- Filler content

Thermomechanical analysis (TMA) measures dimensional changes and can be used to determine:

- Glass transitions
- Coefficients of heat expansion

Dynamic mechanical analysis (DMA) measures viscoelastic properties and can be used to determine:

- Storage modulus and loss modulus as a function of temperature and/or frequency
- Glass transitions, secondary relaxation
- Post-curing of adhesives

Other uses:

- Creep and relaxation measurements
- Static force-controlled tests
- Increase in strength during curing
- Gel point determination

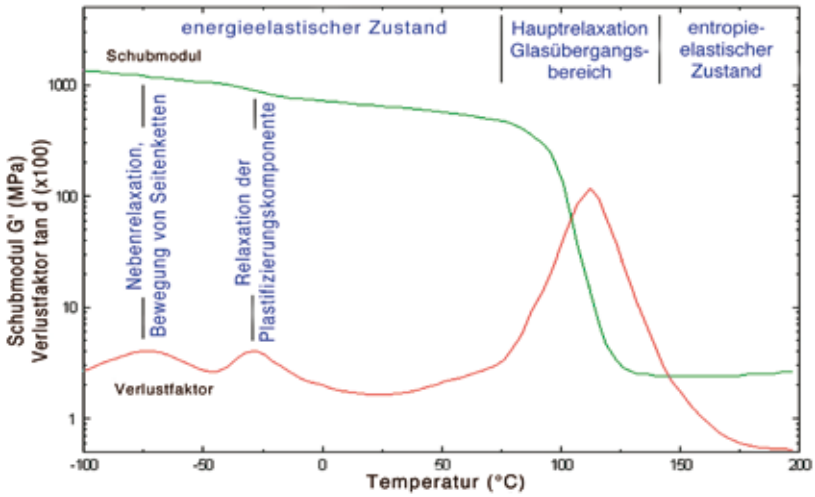
Application areas

➔ **Development and selection of materials**
Mechanical and thermal properties – resistance to aging and moisture

➔ **Process optimization**
Determination of suitable processing parameters

➔ **Quality assurance**
Demonstration of required properties

➔ **Damage/failure analysis**
State of curing of reactive resins



DMA: Thermomechanical states of a one-component epoxy resin adhesive.