

A photograph of a man and a woman in a laboratory. The man, on the left, is wearing a white lab coat, safety glasses, and is smiling while holding a blue pipette tip. The woman, on the right, is also wearing a white lab coat and safety glasses, and is smiling. The background is a bright, out-of-focus laboratory environment.

Testing facilities at BÜFA Composite Systems

Product Development and Application Technology

- Daily work with reactivity, viscosity and colour measurements
- Facilities for applications, analysis, fire resistancy and long term performance

Targets

- High quality of the final product
- Better understanding of the product behaviour/performance
- Application know-how

Fire retardant properties

- Cone calorimeter acc. to ISO 5660
- Testing chamber acc. to DIN 54 837 (DIN 5510)
- LOI acc. to ISO 4589-2



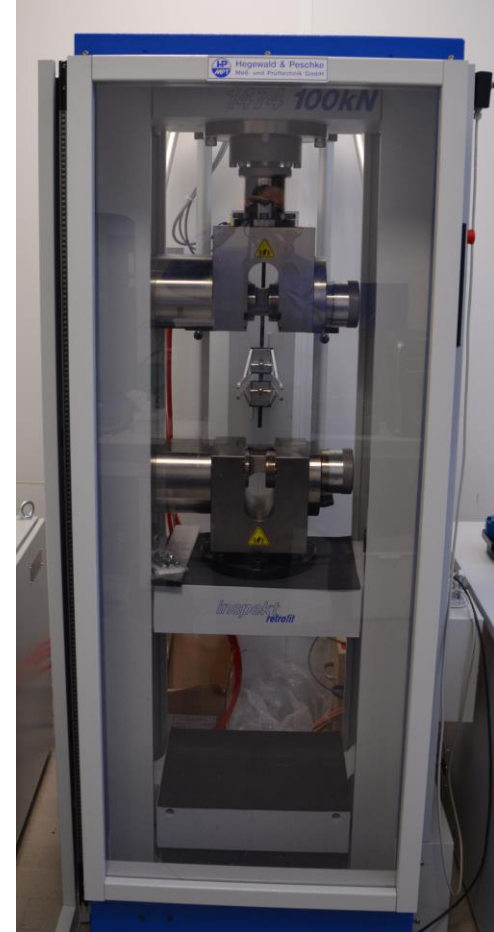
Accelerated weathering tests

- XENON acc. to ISO 4892-2
- QUV test acc to ISO 4892-3



Mechanical properties

- Tensile strength acc. to EN ISO 527-4
- Bending strength acc. to ISO 14125
- Interlaminar shear strength acc. to ISO 14130
- Compressive strength acc. to EN ISO 14126



Analysis

- Glass content acc. to DIN EN ISO 1172
- Osmosis resistancy



Viscosity vs. thixotropic

- Shear rates
- Time effect
- Test methods

Viscosity:

The viscosity of a fluid is a measure of its resistance to gradual deformation by **shear stress** or tensile stress. For liquids, it corresponds to the informal concept of "thickness"; for example, honey has a much higher viscosity than water.

Thixotropy:

Thixotropy is a time-dependent **shear thinning** property. Certain gels or fluids that are thick (viscous) under static conditions will flow (become thin, less viscous) over time when shaken, agitated, or otherwise stressed (time dependent viscosity). They then take a fixed time to return to a more viscous state.

Type of liquids

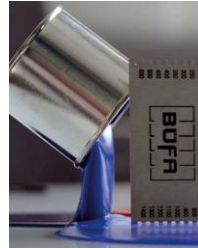
Newton fluid:

- Water
- Honey



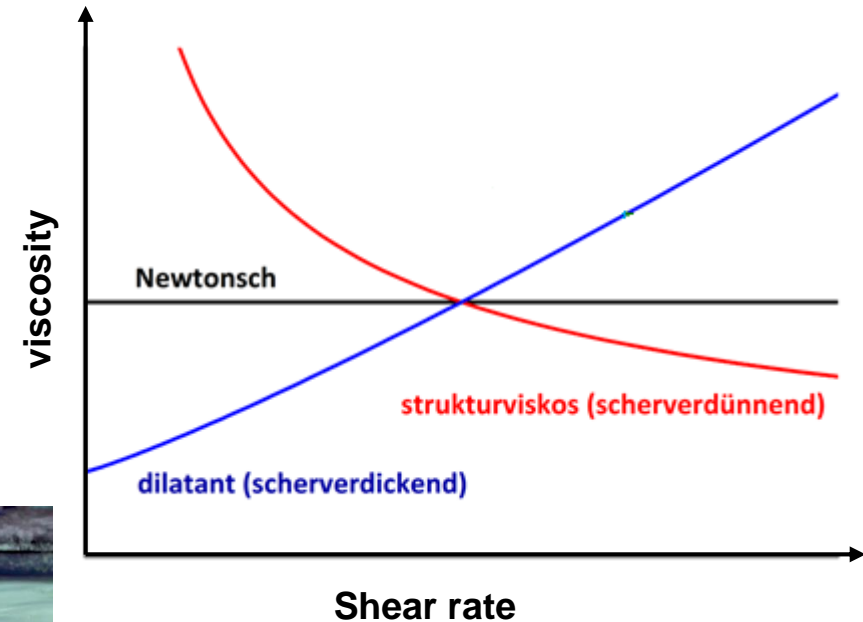
Thixotropic:

- Ketchup
- Gelcoats



Dilatant:

- Water + corn starch



- | | |
|--------------|------------------------------|
| - Brookfield | ~100 s ⁻¹ |
| - Brushing | 100 - 5000 s ⁻¹ |
| - Spraying | 1000 - 10000 s ⁻¹ |

Spray application

Shear rate influenced by:

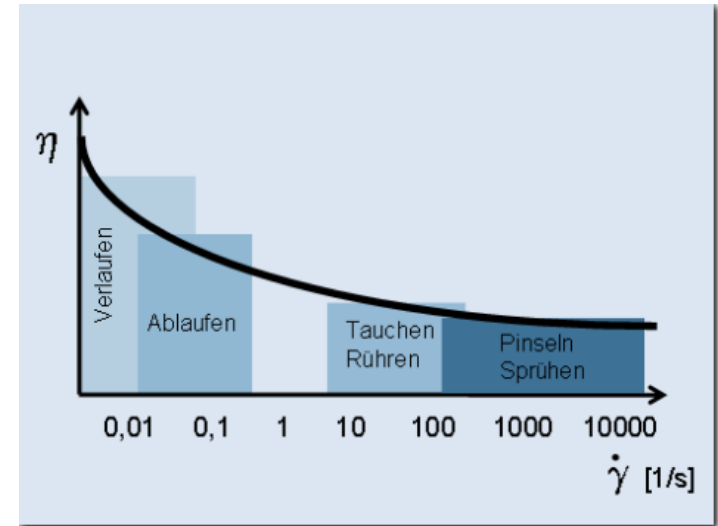
- Temperature
- Pump system / size
- Pressure ratio / pressure
- Hose length
- Nozzle size

BÜFAtec strategy:

„Low pressure application“

→ Low emission

→ Forgiving process → Thixotropic system



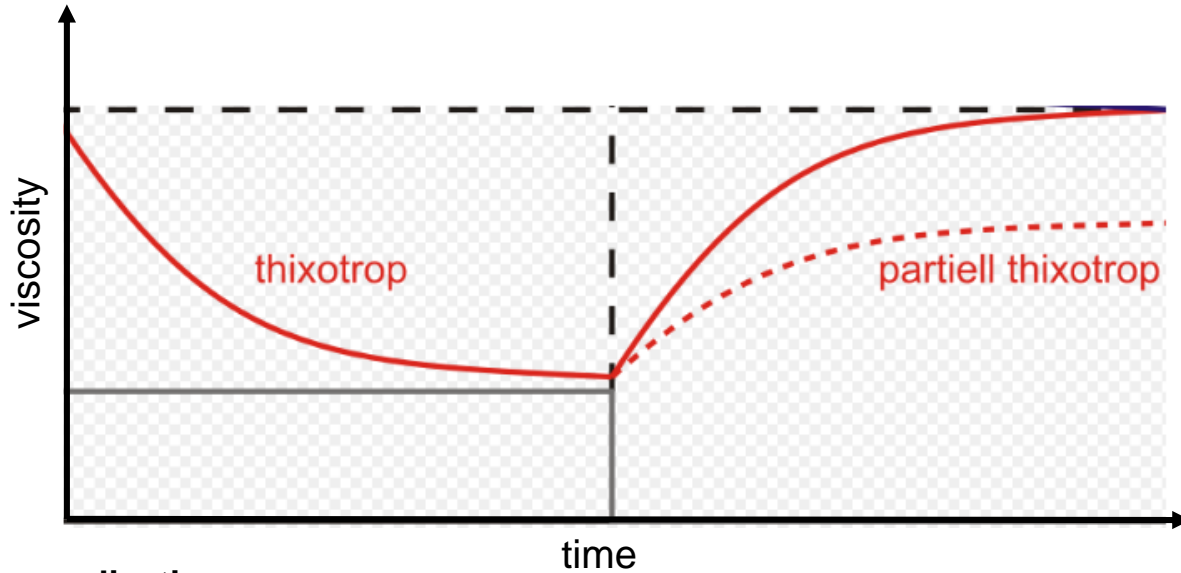
„Brookfield Viscometer“ ISO 2555

- Standard testmethod
 - Spindel (Nr.)
 - Speed (rpm)
 - Temperature (°C)
- Just viscosity values with low shear rate

„Rheometer“

1. Shear (also low shear rate)
2. Viscosity control by oscillation
3. Thix effect





Spray application:

- High shear rate \rightarrow low viscosity

Recovery:

- No shear rate \rightarrow viscosity increases with the time
- Air release need to be finished before viscosity geltime is reached

„Physical“
Gelttime:

In dependence on
DIN EN ISO 2535

→Geltimer

→Spind



„Cup test“:

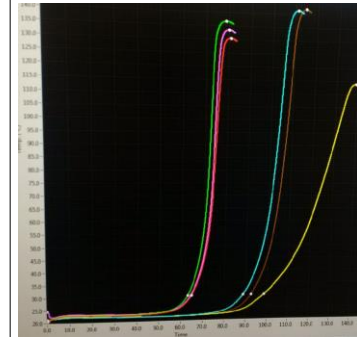
In dependence on DIN 16 945 6.2.2.1

- 100g Cup Volume
- Hardener: Type,
Volume / Weight
- Water bath: Starting
temperature

Geltime: time for reaching 30°C

Curing time: time for reaching
Tmax

Tmax: Peak temperature

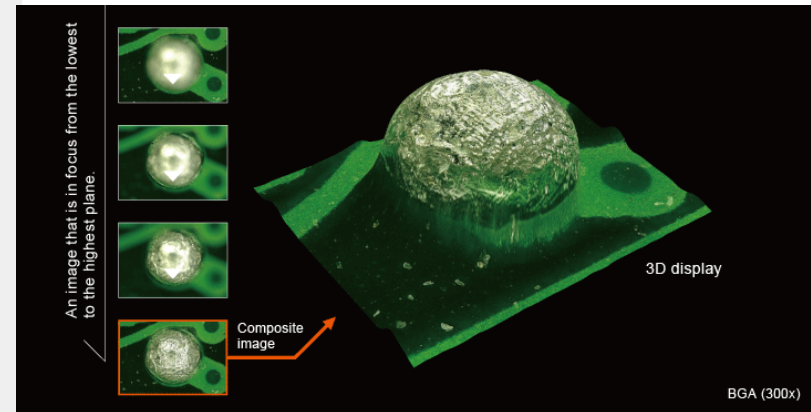
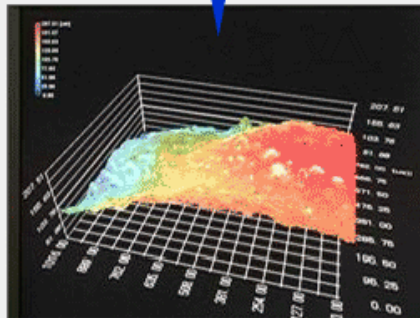


Analysis

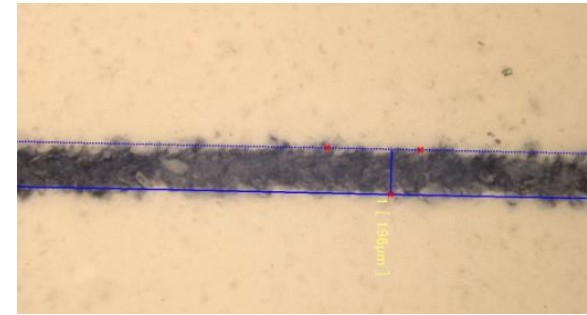
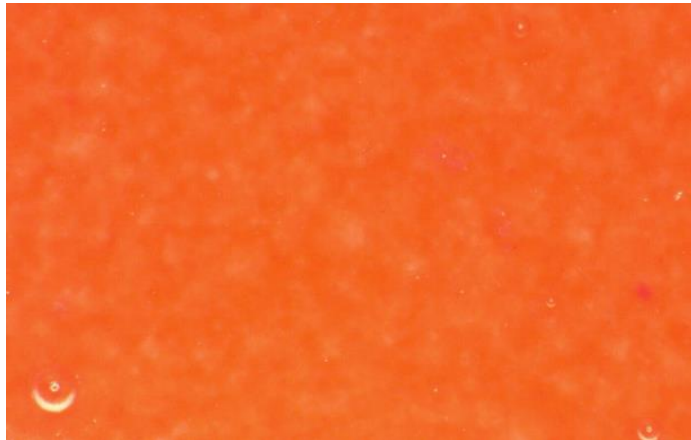
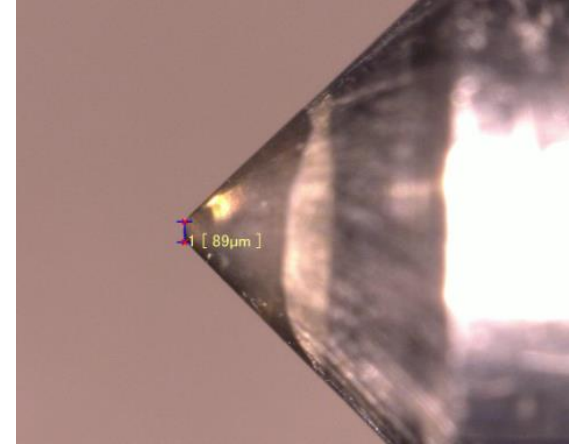
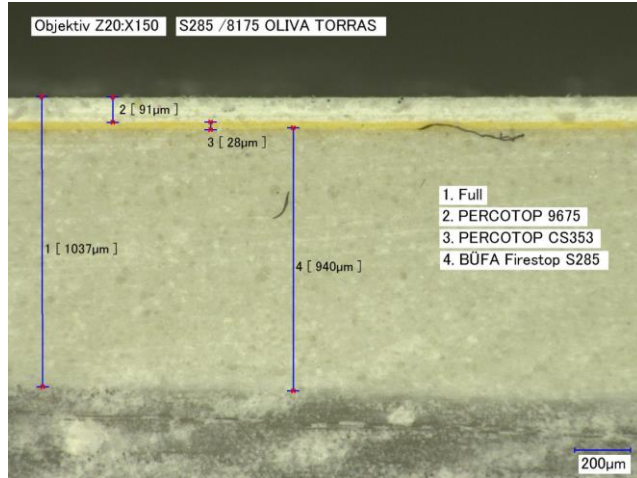
- digital microscope
 - Magnification up to 1000 times
 - 3 D pictures possible



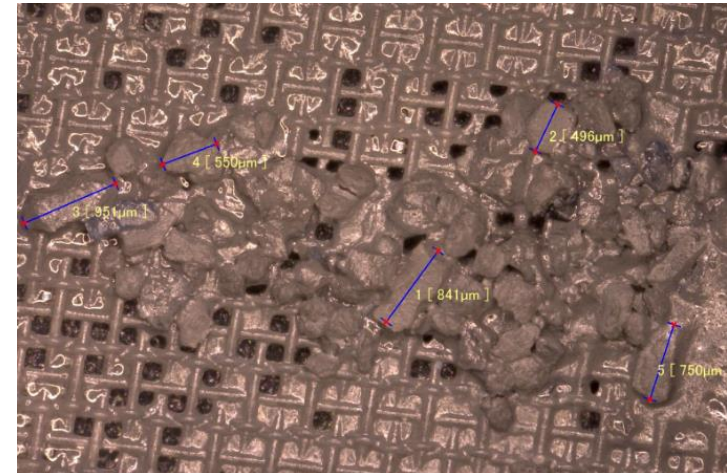
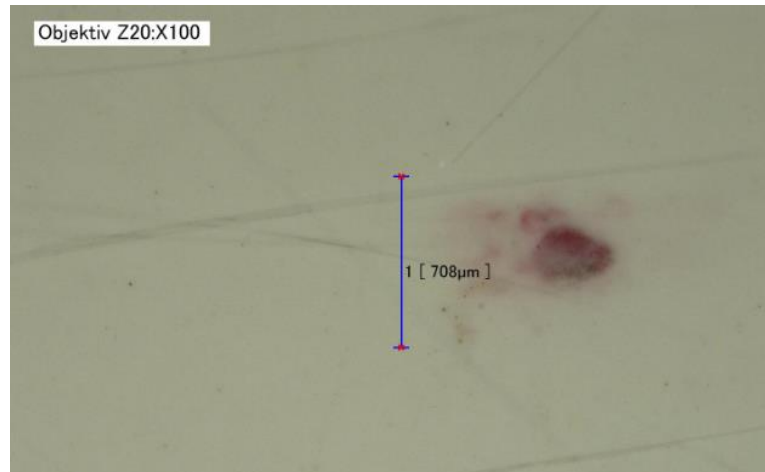
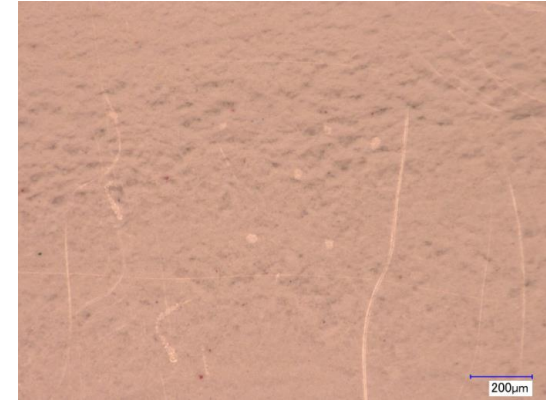
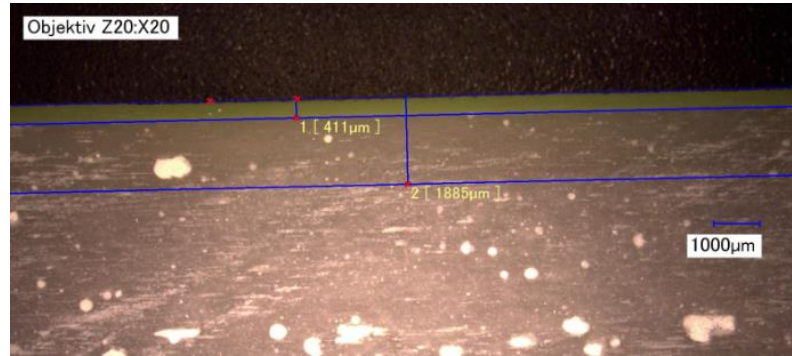
3-D Profile Measurement



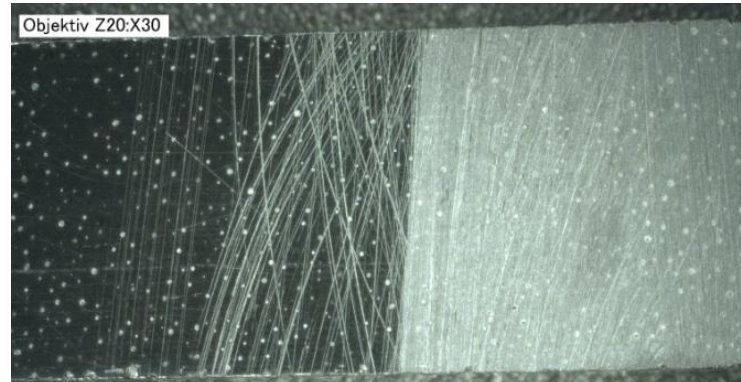
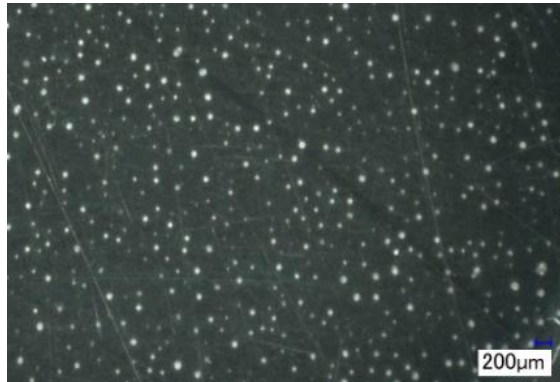
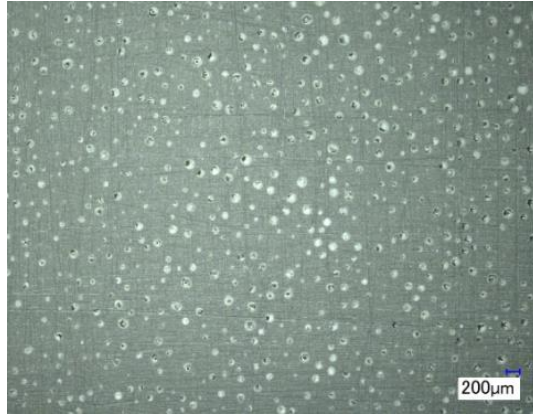
Examples



Examples

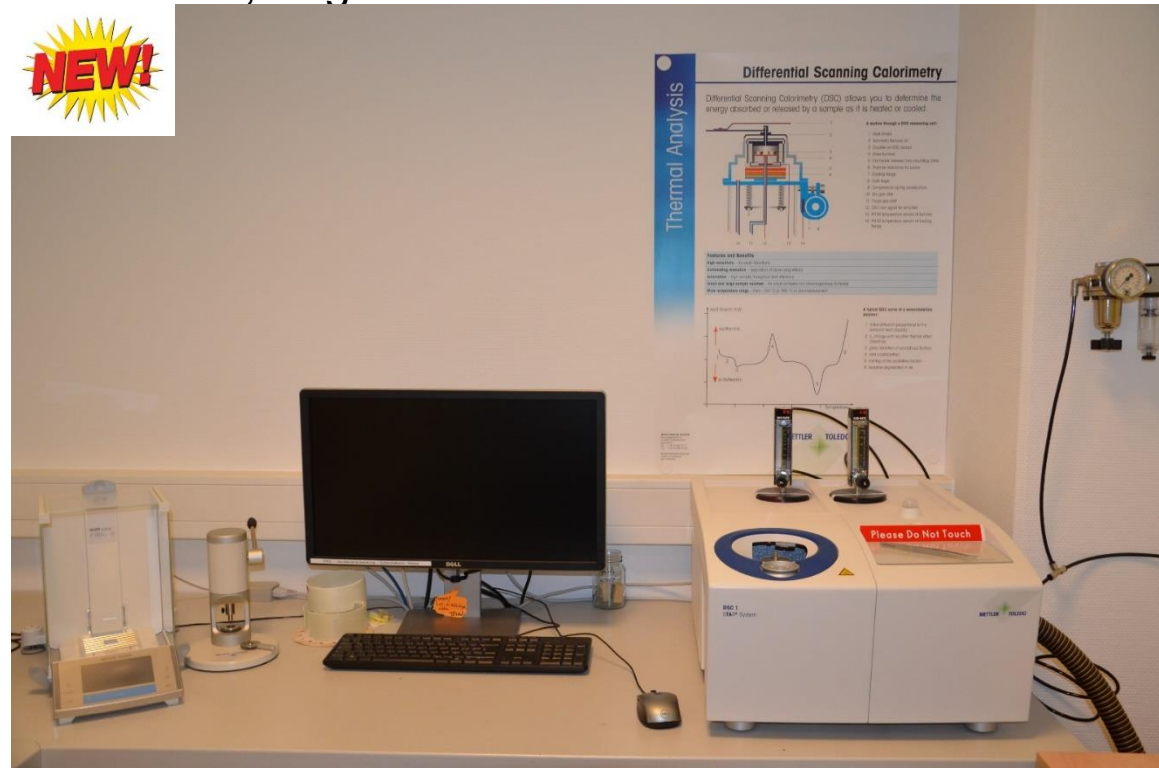


Example

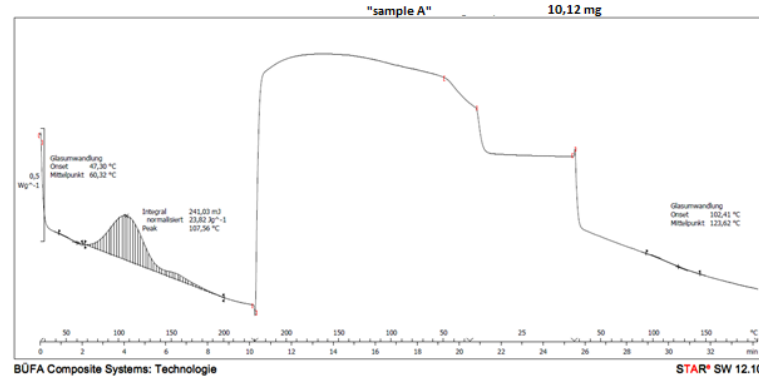


Analysis

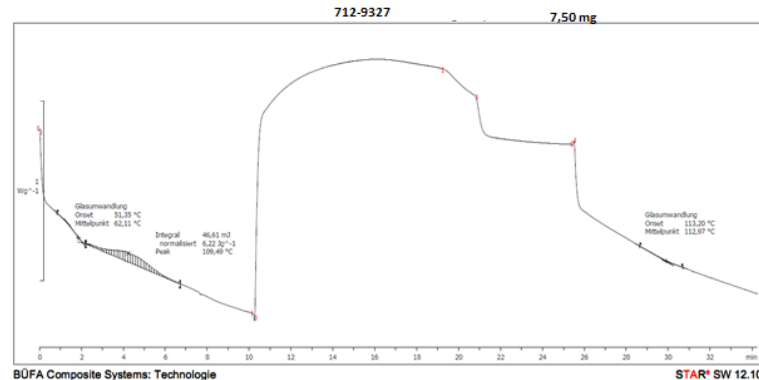
- DSC, Tg measurement, degree of cross-linking



Differential Scanning calorimetry (DSC) of not postcured samples



Tg₁: 60,3 °C
Postcuring: 23,8 J/g
Tg₂: 123,6 °C



Tg₁: 62,1 °C
Postcuring: 6,2 J/g
Tg₂: 112,9 °C

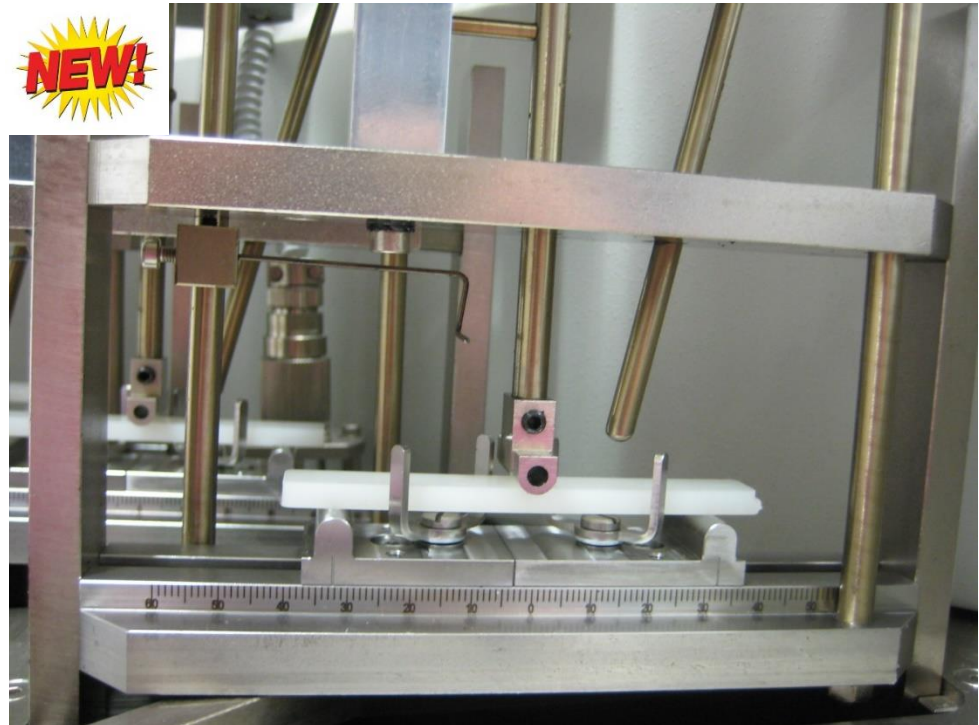
Analysis

- Flash point acc. to ISO 13736



Analysis

- HDT acc. to ISO 75 A,B,C
- January 2016



Analysis

- Taber Abresor acc. to EN 438-2
- Scratch resistancy acc. to EN 14688

NEW!



Application technology

- BÜFA Tec Gamma 4 for bonding paste application
- BÜFA Tec Delta 5.5 for gelcoat spray

