

## Measuring cell for UV assisted thermal curing and simultaneous FTIR spectroscopy

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### Keywords

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In many industrial segments, the use of UV-curing materials for the processing or application of paints, inks, adhesives, coatings, and others, is of great importance. This technology combines environmental and economic advantages with improved product features:

- Higher throughput in production processes thanks to faster curing
- Higher profitability because of less required space in manufacturing plants, there is no need for post-treatment of exhaust fumes and no need for Ex-protection
- Solvent-free products for environmentally friendly processes and improved working safety
- Optimized product features, including a better corrosion and abrasion protection, better chemical resistance and better formability

For measurements on UV-curing materials, a module for the Thermo Scientific™ HAAKE™ MARS™ Rheometers has been developed. This module consists of an upper shaft with an integrated mirror and an exchangeable quartz glass plate, as well as a holder for a collimator plus a light guide, which is mounted to the measuring head of the rheometer. The UV light beam of a commercially available light source, first bundled by the collimator and then reflected by the mirror, is directed into the sample vertically from above through the quartz glass plate. The quartz glass plate is the upper plate of a plate/plate measuring geometry, whereas the lower plate is part of a standard temperature control module. This allows for a temperature control of the sample within a wide temperature range.

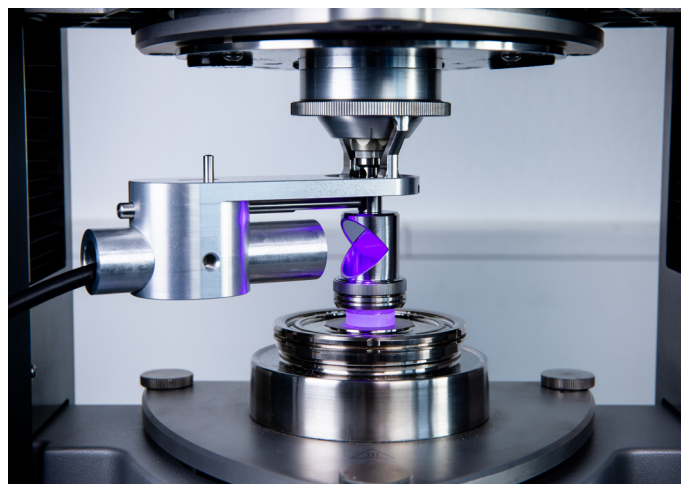


Figure 1: HAAKE MARS Rheometer configuration for UV-curing measurements including temperature control.

Quartz glass plates with diameters of 8 mm and 20 mm are available for the adaption to the different viscosities and G moduli of the samples. The quartz glass plates are available in two different versions: a circular model, which needs a separate clamp ring made of stainless steel, as a simple, low-cost version, as well as a one piece glass model with an integrated clamping surface.

A selection of different standard temperature modules for plate/plate measuring geometries (TM-XX-P) using different technologies like a Peltier-element, electrical heating plus liquid cooling, or a circulator are available to cover a wide range of temperatures and applications. Alternatively, the UV module can be combined with the (temperature controlled) Rheonaut module for simultaneous measurements of rheological properties and FTIR spectra to investigate structural changes within the sample (1).

The use of the optional available sample hood is recommended for measurements beyond ambient conditions. This hood is made out of polyether ether ketone (PEEK) and can be used for temperatures up to 260 °C.

Using the Thermo Scientific™ HAAKE™ RheoWin™ Rheometer Software, fully automated measuring and evaluation routines can be created, including an automatic triggering of the UV light source. Especially for very fast curing materials a new measuring mode - the so-called FastOSC for oscillatory tests - has been developed (2). FastOSC offers a data acquisition rate of 500 Hz (i.e., one data point per 2 ms) independent of the oscillation frequency.

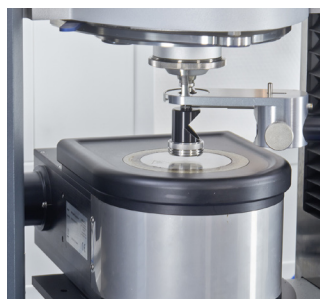


Figure 2: Measuring geometry and adapter for mounting and adjusting the collimator and light.

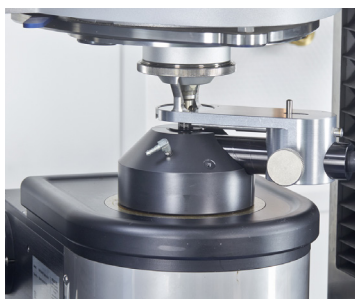


Figure 3: UV module with sample hood.



Figure 4: Accessories for the UV module: left: tool for spreading the glass plate clamps, clamps for circular glass plates with diameters of 8 and 20 mm, 8 and 20 mm circular glass plates with and without clamps, right: the one piece 8 and 20 mm plates glass, upper measuring geometry.



Figure 5: Upper measuring geometry consisting of a shaft with integrated mirror and a screw holder ring for mounting the exchangeable quartz glass plate, here with a circular quartz glass plate with 20 mm and steel clamp ring.

## References

1. C. Küchenmeister-Lehrheuer, J.Ph. Plog, Spectroscopical insight into rheology with the Rheonaut module for the HAAKE MARS rheometer, Thermo Fisher Scientific Product information P033
2. C.Küchenmeister-Lehrheuer, J. Nijman, Kiyoji Sugimoto, Measuring fast UV curing materials using oscillatory rheometry, Thermo Fisher Scientific Application note V246

## Ordering information

Product	Order no.
UV module consisting of a shaft with integrated mirror, screw holder ring for mounting an exchangeable quartz glass plate incl. adapter and collimator for a UV light guide (UV light guide and UV light source not included):	
for HAAKE MARS Rheometer models 40 & 60 with "Connect Assist"	222-2198
for HAAKE MARS Rheometer predecessor models	222-2036
<b>Necessary accessories</b>	
Version 1 - Circular quartz glass plates with separate clamp ring:	
Tool for spreading quartz glass clamps	222-2038
Clamp rings (3 pcs.) for circular quartz glass plates with a diameter of 8 mm	222-2039
Circular quartz glass plates with a diameter 8 mm (10 pcs.) for use with clamp ring 222-2039	222-2040
Clamp rings (3 pcs.) for circular quartz glass plates with a diameter of 20 mm	222-2041
20 Circular quartz glass plates with a diameter of 20 mm (10 pcs.) for use with clamp ring 222-2041	222-2042
Version 2 - One piece quartz glass plates with integrated clamping surface:	
One piece quartz glass plates with a diameter of 8 mm (3 pcs.)	222-2043
One piece quartz glass plates with a diameter of 20 mm (3 pcs.)	222-2044
UV light source: different models of LED and mercury vapor lamps available, e.g. model Omnicure S2000 incl. radiometer, trigger cable (222-2046) and safety glasses	222-2045
<b>Recommended accessories</b>	
Sample hood (PEEK):	
for HAAKE Rheonaut module	222-2047
for previous temperature units (plate /cone) with measuring plate cover MPC	222-2048
for temperature modules TM-XX-Y	222-2034

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