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New UV module for UV curing measurements

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Key-words

- Thermo Scientific HAAKE MARS
- UV-curing
- UV assisted thermal curing
- Fast oscillation (FastOSC)

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

- Higher throughput in production processes thanks to faster curing
- Higher profitability because of less required space in manufacturing-plants, no need for post-treatment of exhaust fumes and no need for Ex-protection
- Solvent-free products for environmental 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 new module for the HAAKE MARS rheometer platform 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 light guide, which is mounted to the HAAKE MARS measuring head. 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.

Quartz glass plates with diameters of 8 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 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 new 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 Teflon and can be used for temperatures up to 240 °C.

Using the 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.

Order information

603-0645 UV module for a HAAKE MARS rheometer, consisting of a shaft with integrated mirror, screw holder ring (for mounting an exchangeable quartz glass plate) incl. adapter and collimator for an UV light guide (UV light guide und UV light source not included)

Necessary accessories:

HAAKE MARS with lower temperature module (e.g. Peltier) or Rheonaut module for simultaneous measurements of rheological properties and



Fig. 1: HAAKE MARS III configuration for UV curing measurements incl. temperature control



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

- FT-IR spectra, exchangeable quartz glass plates (depending on the application):
- 603-0761 Tool for spreading quartz glass clamps
 - 603-0762 Clamp rings (3 pcs.) for circular quartz glass plates with a diameter of 8 mm (603-0763)
 - 603-0763 Circular quartz glass plates with a diameter of 8 mm (10 pcs.)
 - 603-0764 Clamp rings (3 pcs.) for circular quartz glass plates with a diameter of 20 mm (603-0765)
 - 603-0765 Circular quartz glass plates with a diameter of 20 mm (10 pcs.)
 - 603-0766 One piece quartz glass plates with a diameter of 8 mm (3 pcs.)
 - 603-0767 One piece quartz glass plates with a diameter of 20 mm (3 pcs.)

- 603-0769 Sample hood made out of Teflon
- 603-0550 UV light source with trigger function (model Omnicure S2000) incl. light guide and radiometer

Literature

- [1] Thermo Scientific Product Information PI33 “Spectroscopical insight into rheology with the Rheonaut module for the Thermo Scientific HAAKE MARS rheometer”,
Cornelia Küchenmeister and Jan Philip Plog
- [2] Thermo Scientific Application Note V246 “Measuring fast UV curing materials using oscillatory rheometry”,
Cornelia Küchenmeister, Jint Nijman and Kiyoji Sugimoto



Fig. 3: Accessories for the UV module: 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, the one piece 8 and 20 mm plates glass, upper measuring geometry



Fig. 4: 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

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P-037_08.07.2011

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