

## Universal Peltier temperature module for UV-curing applications

### Author

Fabian Meyer, Thermo Fisher Scientific, Karlsruhe, Germany

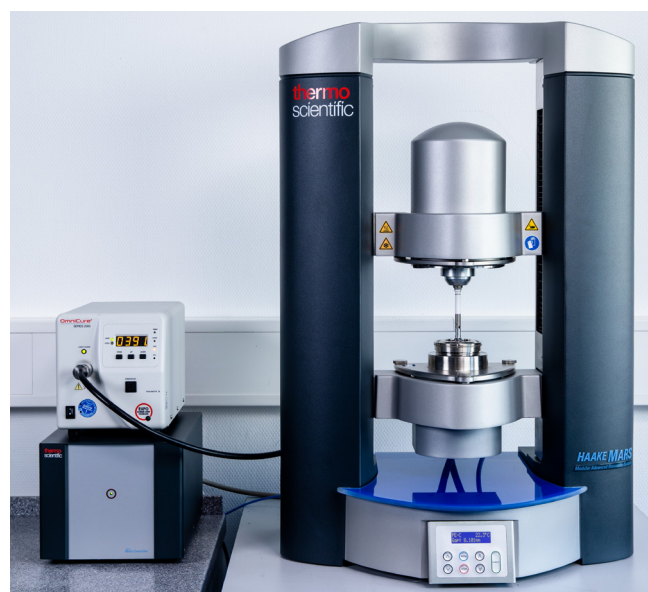
### Keywords

(Thermal assisted) UV-curing, rheometer, disposable geometries, measuring geometries, parallel plates, cone & plate, coaxial cylinders

A universal Peltier temperature control module is available for Thermo Scientific™ HAAKE™ MARS™ Rheometer models 40, 60 (and predecessor models) and allows for the rheological investigation of curing reactions initiated by UV light radiation. The module can be used with regular parallel plate rotors up to a diameter of 25 mm. In case samples are tested that are difficult to remove from the geometry in the fully cured state; also disposable plates are available. Figure 1 shows the module mounted to HAAKE MARS 60 Rheometer, and in this example, connected to an Omnicure S2000 UV light source. Other UV sources are available on request, both as mercury vapor lamps and as LEDs with one or more wavelengths (1).

The setup is based on a Peltier temperature module for coaxial cylinder geometries. It includes a special UV adapter that directs the UV light from the bottom through a quartz glass plate directly into the sample. The adapter comprises a mirror and a collimator. The collimator guarantees a homogeneous distribution of the UV light intensity across the sample. UV light generated by an external UV light source (such as the Omnicure S2000 UV light source) is introduced to the cell via a light guide at the rear side of the module. Depending on the temperature range, different light guides - glass fiber or liquid-filled - are available. Figure 2 shows a schematic drawing of the universal Peltier temperature control module with the UV adapter.

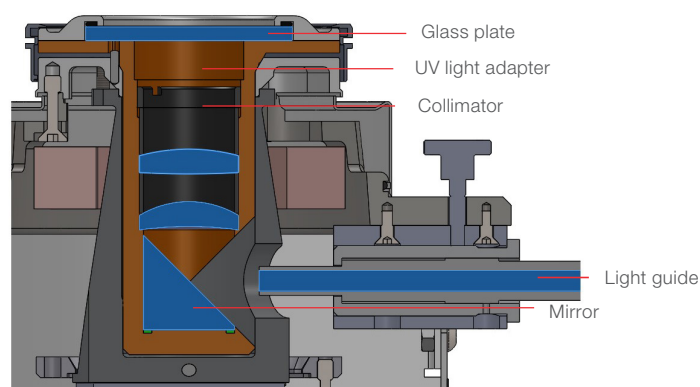
An exchangeable adapter coupling allows for connecting light guides of different diameters (depending on the utilized UV light source and the required temperature range). Peltier



**Figure 1: Universal Peltier temperature control module for UV-curing applications mounted to a HAAKE MARS 60 Rheometer and connected to an Omnicure S2000 UV light source.**

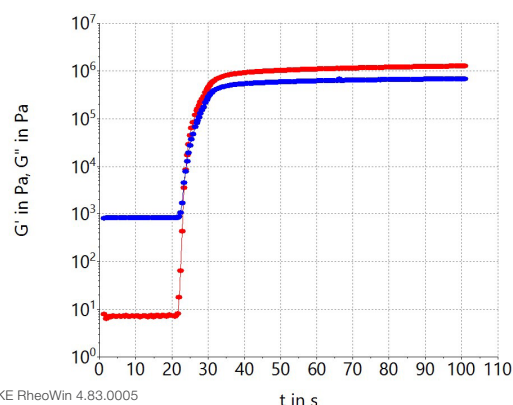
elements at the bottom of the module enable rheological tests in a temperature range from -20 °C\* to +180 °C. Materials with high thermal conductivity are used for the heat transfer inside the temperature control module. The universal Peltier temperature control module can be used with all standard sample covers available for the HAAKE MARS Rheometers. The sample covers do not only promote a more homogeneous temperature distribution within the sample, but also protect the operator from direct exposure to UV radiation. For investigating thermal assisted UV-curing reaction, the module can be used in combination with an active upper electrical temperature module. With this configuration, UV-curing tests up to temperatures of 180 °C can be carried out with a minimized temperature gradient within the sample. When the module is not equipped with the

UV adapter, it can be used with regular 32 mm coaxial cylinder geometries to perform standard rheological tests. When using an optionally available adapter insert, the Peltier temperature module can be extended to the usage with parallel plates and cone and plate geometries. The insert is made of Ampcoloy® for fast heat transfer from the Peltier element to the lower plate of the geometry. The change between the UV-curing configuration and the standard setups for coaxial cylinders or cone and plate/parallel plates is a matter of seconds.



**Figure 2: Schematic drawing of the universal Peltier temperature module with the UV adapter.**

Figure 3 shows the rheological results of a typical curing reaction tested with the UV-curing setup and a HAAKE MARS Rheometer. It can be seen that the data for the storage and the loss modulus change of several orders of magnitude in a short period of time once the sample is exposed to UV light. For the shown set of data, this happened after 20 seconds of experimental time. The UV light exposure is triggered automatically by the Thermo Scientific™ HAAKE™ RheoWin™ Rheometer control software.



**Figure 3: Rheological results of a typical curing reaction tested with the UV-curing setup and a HAAKE MARS Rheometer.**

## Ordering information

Product	Order no.
TM-PE-C UV universal Peltier temperature module for UV-curing and for coaxial cylinder geometries for HAAKE MARS Rheometers (UV light source, light guide, and adapter not included).	222-2331
<b>Necessary accessories</b>	
Heat exchanger HX R or Circulator*	222-2339
Power supply	222-1897
UV light source: e.g. Omnicure S2000 incl. Radiometer Model R2000, and trigger cable	222-2045
Glass fiber light guide (5 mm) for entire temperature range of TM-PE-C UV Adapter (required), has to be ordered in addition	222-2379 222-2387
Liquid-filled light guide (8 mm) for temperature up to 60 °C Adapter (required), has to be ordered in addition	222-2366 222-2390
<b>Recommended accessories</b>	
Spare parts kit for TM-PE-C UV (borosilicate glass plates 5 pcs. and gaskets 5 pcs.)	222-2388
Adapter ring for the use of measuring cups C32	222-2381
Adapter insert for using TM-PE-C UV with parallel plates or cone & plate geometries	222-2010

\* The lowest available Peltier temperature depends on the temperature of the circulating heat sink fluid and the performance of the attached thermostat.

## References

1. Ph. Beutler, Mercury vapour lamp or LED?, Thermo Fisher Scientific Product information P072
2. Ph. Beutler and C. Küchenmeister-Lehrheuer, Universal Peltier temperature module for UV-curing with LED lamp, Thermo Fisher Scientific Product information P073

For more information, please visit  
[thermofisher.com/rheometers](https://thermofisher.com/rheometers)

thermo scientific