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Spectroscopical insight into rheology with the Rheonaut module for the Thermo Scientific HAAKE MARS Rheometer

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Key-words

- Rheonaut
- Thermo Scientific HAAKE MARS
- Plate / plate- and cone / plate measuring geometries
- FT-IR spectroscopy
- ATR principle
- Combined methods

With the Rheonaut a compact module has been developed* to investigate structural changes of a material on the molecular level using FT-IR spectroscopy.

With the patented Rheonaut module a standard FT-IR spectrometer with side port and the Thermo Scientific HAAKE MARS rheometer are coupled to form one measuring unit. Suitable spectrometer models are e.g. the Thermo Scientific Nicolet iS10. This module is designed for using a plate/plate-, cone/plate-measuring geometry for all testing methods offered by the HAAKE MARS rheometer. The stationary plate of the rheometer features a monolithic diamond element that serves as the ATR (attenuated total reflection) sensor, offering a single internal reflection. It has an excellent inertness to chemicals and abrasion. Compared to standard infrared transmission spectroscopy or specular reflection spectroscopy techniques, the sample thickness can thus be adjusted to the rheological needs and is independent from the IR requirements. Accordingly, any plate or cone geometry up to a diameter of 60 mm can be used.

The Rheonaut module can be equipped with two different temperature control units in order to guarantee a homogeneous temperature distribution as well as for temperature-dependent tests such as thermal curing reactions. A Peltier temperature control unit (0-100 °C) and an electrical unit for temperatures from ambient up to 400 °C are available.

As fully integrated solution the definition of the rheological parameters as well as the definition of the numbers of spectra and a following correlation between the rheological data and spectra are integrated in the rheometer software HAAKE RheoWin (for selected spectrometer suppliers/models). In addition the lower plate can be moved via software control. Several

wire grid polarizers are optionally available to set the polarization direction for the infrared radiation both parallel and perpendicular to a fixed reference direction.

The Rheonaut technology enables a new level of understanding of rheological properties and processes, which depend on changes on the molecular structure. On the one hand, deformations and orientations of molecules as function of shear can be monitored. On the other hand the in-situ-spectroscopy enables the investigation of chemical reactions in the measuring gap such as chemical or thermal curing of polyurethane (PU)- or epoxy- adhesives.

Order information

The Rheonaut module consists of an optical unit (ready to enable purging) with integrated DTGS detector with preamplifier, controller for a Peltier or electrical temperature unit, HAAKE MARS frame extension to hook up a commercially FT-IR spectrometer .

Necessary accessories:

FT-IR spectrometer with side port e.g. Thermo Scientific Nicolet iS10, HAAKE MARS rheometer and a measuring geometry consisting of a lower exchangeable measuring plate with single reflection crystal (diamond) and upper plate or cone as well as HAAKE RheoWin FT-IR-control software module with spectrometer



Fig.2: Rheonaut module

trigger, integrated spectrum settings, rheometer evaluation software with link to spectra data (for selected spectrometer supplies/models)

- 603-0600 Rheonaut module
 - 603-0601 Lower ATR plate (exchangeable) incl. electrical temperature unit
 - 603-0604 Lower ATR plate (exchangeable) incl. Peltier temperature unit
 - 098-5061 FT-IR spectroscopy tool for HAAKE RheoWin software
- Upper standard measuring geometry e.g. 222-1866 Plate P60 mm titanium or 222-1868 Cone C60/1° titanium

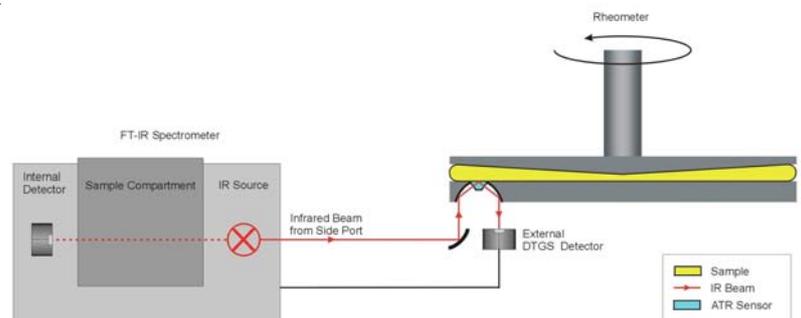


Fig.1: Scheme of the Rheonaut module

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