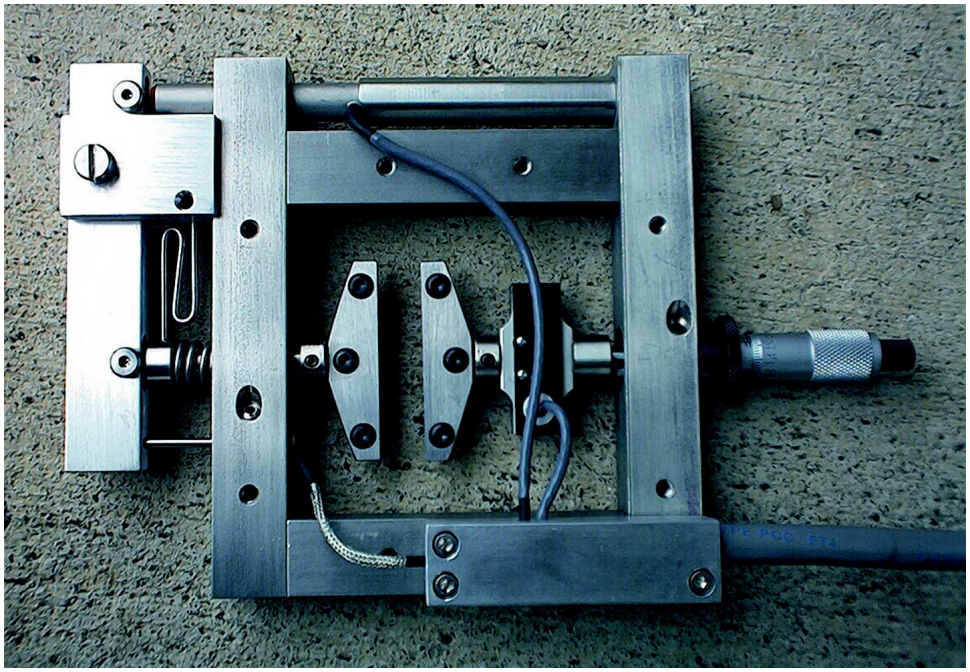
PM-100 Polymer Modulator™ Microrheometer

Accessories for Dynamic Spectrometry of Polymers

Polymer Modulator ™ microrheometers provide a convenient, commercially-available tool for combining spectroscopic measurements with rheological perturbation.



Application of FT-IR spectrometry to rheo-optical studies of polymers has become an accepted approach in the polymer physics and engineering communities. Many studies have measured the time dependence of spectral changes in polymer samples, during modulated strain, with the use of MAT's polymer instrumentation. These systems consist of two components, an electromechanical head (pictured above), where the sample is mounted, and an electronic power unit (pictured below). The head is typically placed in a spectrometer sample compartment, but also may be mounted externally. The head is connected to the electrical power unit by a shielded cable. The power unit contains the necessary circuits to amplify an input signal to drive the piezoelectric transducer, as well as amplifiers and signal conditioning for stress and strain transducers.

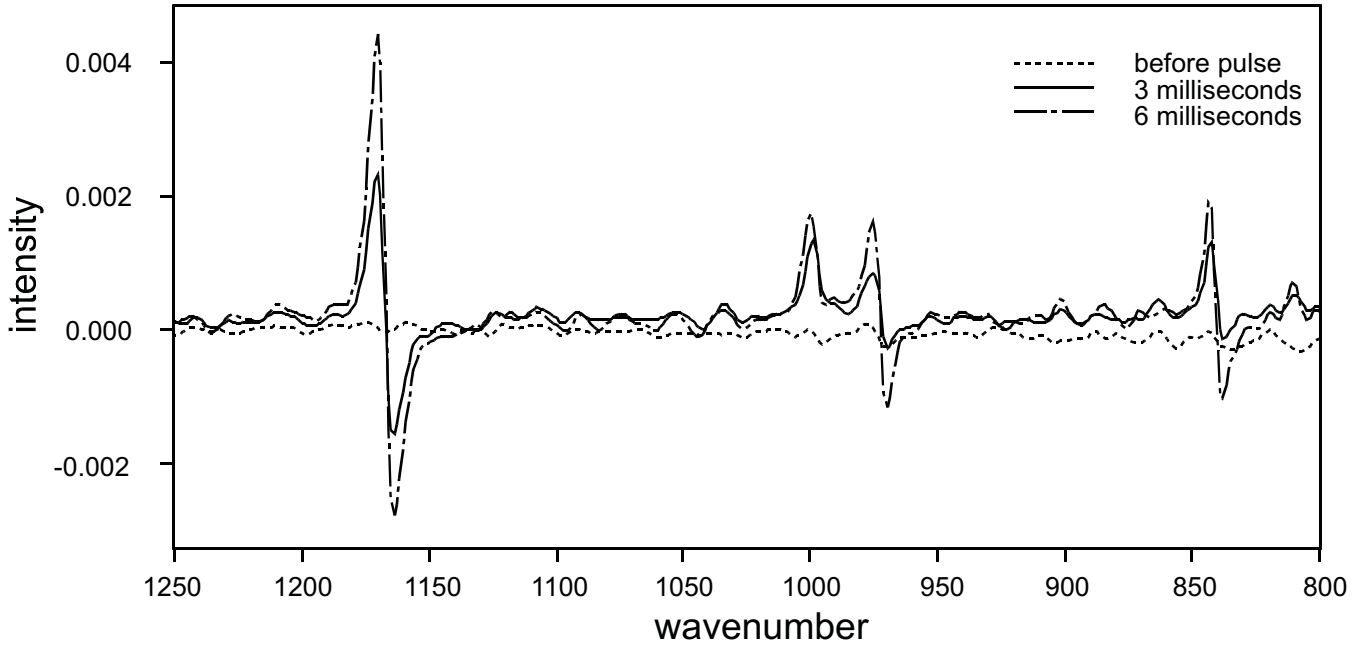
Specifications

- Dynamic strain: 0-0.6% (0-75 µm)
- Frequency range: 0-70 Hz
- Impulse rise/fall time: 5 ms
- Static strain: 0-1.25 cm
- Input signal: 5 volts p-p for full amplitude
- Strain sensitivity: 0.05 µm
- Stress sensitivity: 0.005 N
- Strain output: -10 to +10 volts (20 µm/V)
- Stress output: 0 to +10 volts (10 N/V)
- Sample dimensions: 6 cm (w) x 2.6 cm (l)
- Power: 120/240 V 50/60 Hz 20 W

- Quartz timing accuracy
- Programmable waveforms
- Time-resolved or phase-resolved measurements
- Rack-mountable electronics
- Thermal stability
- Compact size
- Standard BNC connectors
- Limited lifetime warranty on design and workmanship

Example Data

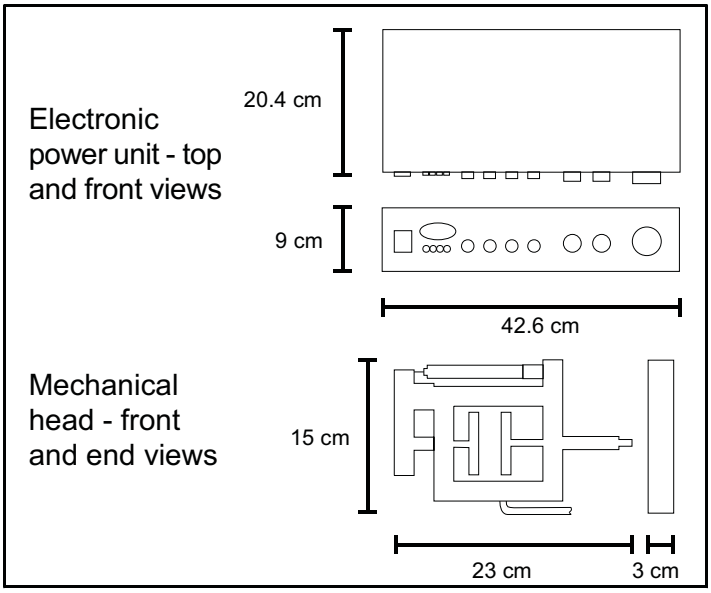
Isotactic polypropylene (iPP) is recognized as the standard sample for mid-infrared testing of rheo-optical instrumentation. The iPP spectra shown here were collected in the pulse mode of operation. Each trace represents the average state of the polymer over a 1 millisecond time slice, measured from 100 transients at each interferometer step, to a resolution of 4 cm^{-1}. The noise level in these spectra is comparable to that obtained by conventional measurements, even though the bandwidth is substantially higher. The three traces represent the state of the sample at 0, 3, and 6 milliseconds after pulse initiation.



Technical Details

Drive waveforms for the Polymer Modulator™ usually are digitally synthesized such that the short- and long-term frequency stability are governed by quartz clock. Because the drive mechanism is piezoelectric, the applied waveform is completely programmable, with full response to component frequencies up to 70 Hz. The device is usable over more than two decades of frequency and is fully instrumented with stress and strain transducers. The frame of the device is fabricated from 303 alloy stainless steel to minimize thermal expansion. The frame has threaded holes for suspending the device, if necessary to avoid coupling vibrations to the spectrometer. The power unit may be mounted in a standard electronic rack. Optional temperature control for the range of -100 to +200 °C also are available.

Dimensions



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