

Unique Automatic Beamsplitter Exchange Unit for a Research Vacuum FT-IR Spectrometer

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Since the introduction of FT-IR spectroscopy, it is very well accepted by the research community that a spectrometer based on a vacuum optics bench provides IR spectra which are free of residual H₂O- and CO₂-absorption bands. Such residual absorptions of the laboratory room air are typically visible under purge conditions and may mask weak spectral features of the measured sample spectrum. But measurements of a sample in the complete IR or THz spectral range require different types of optical components which are mainly detectors, sources and beamsplitters (BMS). The technology for automatic detector and source switching is well established. In contrary to that automatic BMS exchange under vacuum condition has been not yet realized in modern FT-IR spectrometers because of the high technical demand for precision, its complexity and costs. Therefore it was necessary to vent and re-evacuate the spectrometer optics bench for the manual BMS exchange.

In this contribution the functionality of a new and unique automatic beamsplitter exchange unit (BMS-c) for the VERTEX 80v research bench-top vacuum FT-IR spectrometer will be presented. Spectra measured with up to four different types of BMS in connection with a unique Transmittance/Reflectance accessory as well as with a diamond micro ATR unit will be shown. Up to four different types of BMS are mounted on the exchange unit which are e.g. far IR/THz Mylar-BMS with 50µm thickness and the far IR multilayer Mylar BMS as well as the standard mid IR KBr beamsplitter and the wide band UV-VIS-NIR beamsplitter. The used BMS is selected via the instrument user interface and automatically positioned without the need of venting and re-evacuation the spectrometer optics bench. To demonstrate the usability example spectra of different solid and powdered material in the very wide spectral range from 10cm⁻¹ (0.3THz) up to 25,000cm⁻¹ (400nm) have been measured.

In particular for measurements using a liquid He cooled cryostat or samples with unstable morphology the automated BMS exchange unit is of advantage. It avoids any change of the thermal conditions of the optics bench by venting and evacuation and provides therefore very stable measurement results and at the same time significant shorter measurement times.

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