S2050 Mid-Infrared Spectrometer

Data sheet

- 2.0 – 5.0 µm bandwidth
- Up to 130 kHz full-spectrum readout rate
- Down to 5 pW/nm sensitivity
- 6 cm^{-1} resolution on 2048 pixels

The NLIR MIR Spectrometer is based on a novel measurement scheme that upconverts the MIR light to near-visible light. Silicon-based near-visible light detectors are far superior to MIR light detectors in terms of detectivity, speed and noise. The NLIR upconversion technology therefore brings these attractive features, and the advantages that follow, to the MIR regime.

The spectrometer is made in two editions: S2050-400 is the economic version with max. 400 Hz full spectrum, and S2050-130k is the faster version with up to 130 kHz full spectrum. The S2050-400 comes with a comprehensive GUI interface for easy plug-and-play measurements in various applications that do not require faster-than 400 Hz sampling; the S2050-130k has an API interface for advanced users who are looking for the fastest and most sensitive mid-infrared spectrometer commercially available.

	S2050-400	**S2050-130k**	unit
Optical bandwidth	2.0 – 5.0	2.4 – 4.5	µm
Resolution(1)	6		cm^{-1}
Exposure time(2)	10.8 – 1E6	1.3 – 654	µs
Max. readout rate	400	130E3	Hz
Bit depth	16	12	
Dark noise std.(3)	20	1	counts
Minimum detection power in 100 ms	10	5	pW/nm
Optical input(4)	SMA-905 fiber connector		
Polarization direction	Vertical		
Maximum operating temperature	30		°C
Physical dimensions (H×L×W)	100 × 306 × 200		mm^3
Weight	5		kg

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(1) With a 100 µm input fiber. Resolution down to 3 cm^{-1} is available upon request.
(2) Longer effective exposure times can be achieved for the S2050-130k model by stacking acquired spectra.
(3) At minimum exposure time.
(4) Customization for free-space input available upon request.

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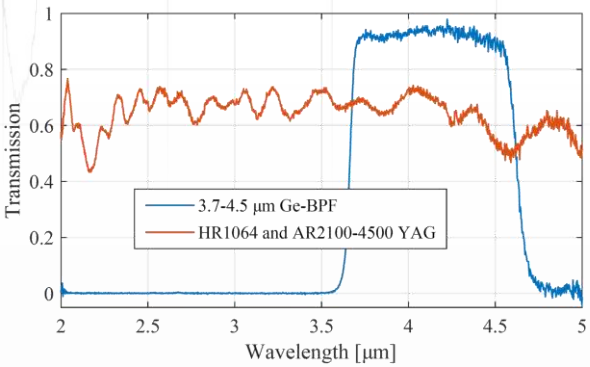
Application examples



Optical coating measurement

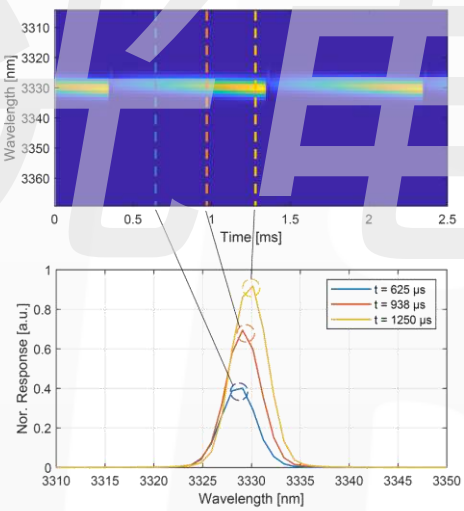
A 30 W globar was used as light source for these transmission measurement of coated optical windows: a Ge bandpass filter (BPF) for 3.7 – 4.5 µm and a YAG mirror coated with high-reflection at 1064 nm and high-transmission at 2.1 – 4.5 µm. The S2050-400 spectrometer was set to 20 ms exposure time and capturing just single shots. No averaging or smoothing has been applied to the data subsequently.

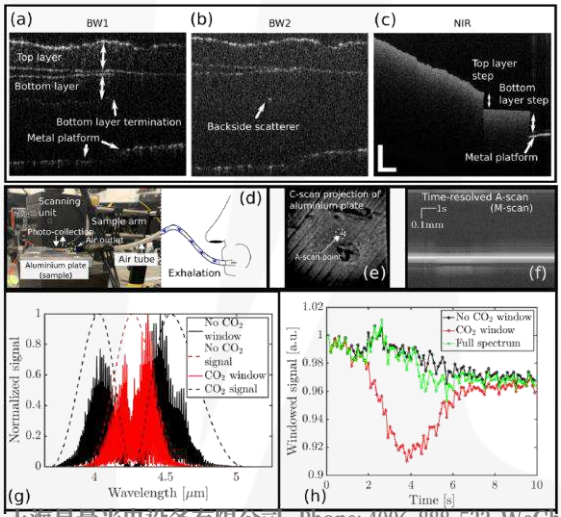
Such measurements are used for coating quality control or even production monitoring.

80 kHz mid-infrared spectroscopy

The drive current of a mid-infrared laser at 3329 nm is modulated in amplitude at 1 kHz and the ultra-fast 80 kHz edition of the NLIR 2.0 – 5.0 µm spectrometer measures the laser spectrum with a temporal resolution of 12.5 µs. When the drive current is modulated, the amplitude and center frequency of the laser changes, and these characteristics are clearly visible in the data shown in the figure.

Measurement done by Marc-Simon Bahr at HAW Hamburg, Department of Information and Electrical Engineering.





kHz-rate optical coherence tomography

Optical coherence tomography is a well-known in-depth imaging technique in the near-infrared that, however, has numerous advantages in the mid-infrared region. The NLIR upconversion technology is used to realize kHz line-rate spectroscopy that enables live mid-infrared OCT monitoring.

From Niels M. Israelsen *et al.,* "High-resolution mid-infrared optical coherence tomography with kHz line rate," Opt. Lett. 46, p. 4558 (2021).