NEMS-FTIR · INFRARED ANALYZER

EMILIE™

EMILIE™ is the first nanoelectromechanical systems (NEMS)-based accessory for Fourier Transform Infrared (FT-IR) spectroscopy. It integrates seamlessly with commercial research-grade FT-IR spectrometers.



SPECTRAL RANGE	CHIP TEMP. CONTROL	PRESSURE RANGE	WEIGHT
30–11,000 cm^{-1}	5–80 °C	10^{-6}–10^{-3} mbar	8 kg

AT A GLANCE

- Infrared analyser for the EMILIE™ nanoelectromechanical sampling and sensing chips
- High sensitivity without cryogenic cooling
- Plug & Play for Bruker Invenio & Vertex research spectrometers
- Diamond light-entrance window for broad spectral coverage
- Integrated temperature control for cooling or heating during thermal desorption/stability studies

TABLE 1 GENERAL SPECIFICATIONS

Dimensions (L×W×H)	20×14×28 cm
Weight	8 kg
Response time	25 ms
Light entrance window	Diamond
Operating wavelength range	30 – 11,000 cm^{-1}

TABLE 2 ENVIRONMENT & OPERATION

Ambient temperature	5 °C to 35 °C
Operation pressure[2]	5×10^{-6} to 10^{-3} mbar
Chip temp. control[3]	5 °C to 80 °C
Operating environment	IEC 61010, indoor, installation category II, pollution degree 2

TABLE 3 PHILL™ CONTROL DEVICE

Power supply voltage	100 – 240 VAC ±10 %, 50 – 60 Hz
Power consumption	6.25 W typ., max. 20 W
Output signal voltage	±3 V DC
Input signal voltage	±1 V DC
Required OS	Windows 10 or higher
Connection to PHILL™	Sub-D 15 cable
Connection to PC	Micro USB 2.0

TABLE 4 VACUUM PUMP REQUIREMENTS[1]

Type	Turbo or scroll pump (oil-free)
Vacuum	<10^{-3} mbar achievable
Connector	KF25 with wall clamps

TABLE 5 PURGE GAS SUPPLY

Purge gas	Dry air or nitrogen (use in well-ventilated environment)
Gas condition	Dry & clean (oil-free, dust-free)
Pressure range	max. 2 bar
Gas flow rate	sustained max. 200 L/hour

TABLE 6 FT-IR SPECTROMETER COMPATIBILITY

Compatible with	Bruker Invenio R / X · Vertex 70/70v · Vertex 80/80v
Required accessory	ASM external Analog-Box (Bruker No. E550/A)
Operating mode	Step scan must be available

TABLE 7 APPLICATION LIMITS OF DETECTION

Proteins[5]	170 – 210 pg
Nanoplastics[6]	100 – 350 pg
Aerosol organics[7]	1.3 – 5.4 ng

TABLE 8 KEY PARAMETERS FOR NEMS-FT-IR OF THE EMILIE™ VALIDATION CHIP[4]

Polystyrene peak	1453 cm^{-1}	1601 cm^{-1}	3026 cm^{-1}	3082 cm^{-1}
24 h drift	1.73 %	1.28 %	1.84 %	0.66 %
Relative standard deviation (RSD)	3.78 %	7.01 %	1.73 %	5.03 %

[1] Recommended with the HiPace® 10 Neo from Pfeiffer Vacuum GmbH — maximal efficiency with minimal footprint.

[2] EMILIE™ has been tested only at the specified operation pressure range.

[3] Minimum temperature achievable by the Peltier element depends on ambient temperature; at 35 °C ambient, 5 °C is reliably achieved.

[4] The EMILIE™ Validation Chip is pre-loaded with 10 ng polystyrene nanoplastic. Measured in conjunction with a Bruker Invenio X, dry-air purging. Peak intensities are normalized to SiN.

[5] NEMS-FTIR Protein Analysis with EMILIE™, Invisible-Light Labs GmbH, 2025.

[6] Timarac-Popović, J., Hiesberger, J., Šesto, E., Luhmann, N., Giesriegl, A., Bešić, H., Lafleur, J.P., Schmid, S., 2026. Picogram-Level Nanoplastic Analysis with Nanoelectromechanical System Fourier Transform Infrared Spectroscopy: NEMS-FTIR. *ACS Nano* 20, 11193–11208. doi.org/10.1021/acsnano.5c22099

[7] Surdu, M., Luhmann, N., Hiesberger, J., Vukićević, V., Démolis, E.A., Favre, L., Dönmez, B., Bešić, H., Kanellopulos, K., Schmid, S., Lafleur, J.P., Takahama, S., Schmale, J., 2026. Quantifying submicrometer atmospheric aerosol chemical composition using nanoelectromechanical Fourier transform infrared spectroscopy. *Science Advances*.