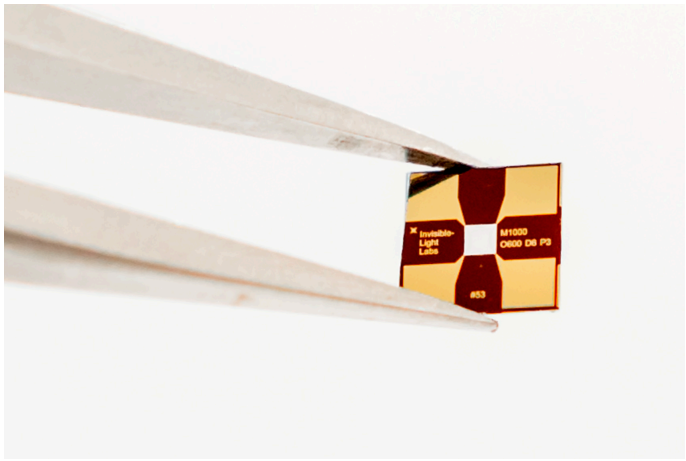
EMILIE™ · CONSUMABLE

EMILIE™ Nanoelectromechanical Sampling & Sensing Chip

The single-use silicon-nitride nanomechanical chip at the heart of EMILIE™. It both collects the sample and detects it, enabling high-sensitivity NEMS-FT-IR analysis with no transfer step in between.



MEMBRANE	CHIP SIZE	SENSING AREA	FORMAT
50 nm SiN	5 × 5 mm 380–525 µm thick	1000 × 1000 µm	Single-use

FEATURES

- Sample holder and detector in one: the analyte is collected directly on the sensing membrane, eliminating transfer and minimizing cross-contamination.
- 50 nm perforated silicon-nitride membrane with gold/chromium electrodes.
- The perforated sampling area enables aerosol collection by impaction as well as drop- and spin-casting.
- Chemically inert, heat-resistant silicon nitride; the intrinsic SiN band at 835 cm^{-1} serves as an internal reference for normalization.
- Single-use. Prevents cross-contamination in trace analysis.

SHARED CHIP PLATFORM

The sampling, validation and light chips share one platform: a 50 nm low-stress silicon-nitride perforated membrane, Ø 600 µm perforated area with 6 µm holes on a 3 µm pitch, gold/chromium electrodes, a unique chip number per batch, and a 5 × 5 mm chip size (380–525 µm thick). The sampling and sensing chip is single-use and should be handled with carbon-fibre-tip high-precision tweezers in clean environments.

TABLE 1 MEMBRANE & STRUCTURE

Membrane material / thickness	Low-stress silicon nitride, 50 nm
Perforated area	Ø 600 µm
Perforation diameter / pitch	6 µm / 3 µm
Electrodes	Gold / Chromium
Chip size (L × W × thickness)	5 × 5 mm × 380–525 µm
Packaging	PVC/POM-C box, Gel-Box™ or capsule

TABLE 2 INTERNAL REFERENCE

Internal reference peak (SiN)	835 cm^{-1} (broad 700 – 1000 cm^{-1})
SiN reference absorptance	0.21 ± 0.01 at 835 cm^{-1}

TABLE 3 MASS LOADING

Dynamic mass-load range	LoD – 200 ng
Optimal mass load	30 ng
Maximum dried mass (avoid overload)	≤ 200 ng

TABLE 4 OPERATION & HANDLING

Chip temperature range in EMILIE™	5 – 80 °C
Handling	Carbon-fiber-tip high-precision tweezers; hold the frame or electrodes, never the membrane

TABLE 5 AEROSOL SAMPLING

Particle size (impaction)	10 – 3200 nm
Impaction collection efficiency	up to 60 %
Max aerosol flow through chip	1.0 L/min

TABLE 6 DROP CASTING SAMPLING

EMILIE™ DROP CASTING ACCESSORY

Capacity	Up to 20 chips simultaneously
Recommended droplet	500 – 1000 nL
Dry time — 500 nL DI water	≈ 30 min
Dry time — 1 µL DI water	≈ 60 min
Sample type	Aqueous samples

COMMERCIAL NANODISPENSING SYSTEM

Droplet volume	2 – 20 nL

TABLE 7 APPLICATION LIMITS OF DETECTION

Proteins[1]	170 – 210 pg
Nanoplastics[2]	100 – 350 pg
Aerosol organic functional groups[3]	1.3 – 5.4 ng

REFERENCES

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

[2] 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

[3] 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*.