MEMS Reliability

Wafer-level electrical characterization and analysis are essential to improve MEMS performance

What it is

CEA-Leti is home to 70 wafer-level testing probers stations, both automated and semi-automated, for electrical behavior and reliability studies across temperature from -40 °C to 1,000 °C, and down to 2 Kelvin. Some probers also operate under vacuum pressures as low as 10^{-5} mbar.

Complete RGA-TDS (residual gas analysis-thermal desorption spectroscopy) allows outgassing and sorption getter characterization under wafer-level packaging conditions, providing quantitative and qualitative data.

This information, combined with CEA-Leti's modeling and analysis capabilities, helps to improve chip functionality, performance and reliability.

What it can do

CEA-Leti's wafer-level characterization capabilities allow device developers and manufacturers to understand what is happening inside MEMS devices:

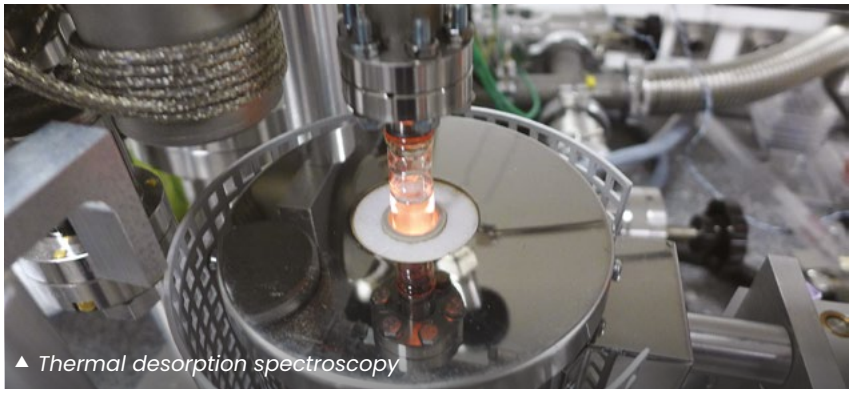
- Hermeticity of wafer level sealed cavities,
- Integrated vacuum lifetime,
- Quality factor and resonance frequencies of resonator modes,
- MEMS behavior studies in harsh environmental conditions,
- Deep defects analysis.

What makes it unique

CEA-Leti's unique range of wafer-level characterization equipment is backed by a team of experts and by characterization protocols developed at CEA-Leti to extract useful information about the physical phenomena involved in the components behavior.

In addition to testing at much wider range of temperatures than standard wafer prober capabilities, CEA-Leti is also home to laser vibrometers, infrared microscopy and lock-in thermography, and the ability to measure and analyze residual gases under vacuum inside volumes as small as 1 mm^3. CEA-Leti has also developed specific modelling capabilities that are particularly useful to improving device reliability.

Finally, CEA-Leti has access to the CEA Nanocharacterization Platform for additional measurements, such as device morphology.



▲ *Thermal desorption spectroscopy*

Working with CEA-Leti

CEA-Leti's wafer-level characterization capabilities are of interest to foundries and fabless companies seeking new insights into the electrical behavior and reliability of their MEMS components.

Companies that partner with CEA-Leti gain access to a world-class slate of wafer-level probers and other advanced characterization equipment, all backed by CEA-Leti's modelling and analysis expertise, plus access to a wider range of measurements like those available at the CEA Nanocharacterization Platform.

Key equipment

- Custom residual gas analysis dedicated to integrated wafer level packaging
- Laser vibrometry to measure resonator behavior at wafer level before packaging under vacuum probe station
- Custom wafer level electrical characterization with physical stimulation (acoustic, etc.)

Scientific publications

- Duchemin, H., Bouchu, D. (2025). "Sorption getter characterization under wafer-level packaging (WLP) conditions." Microelectronics Reliability, Volume 168, 2025, 115677
- Boutonnet, C., et al. (2025). "Characterization of a Multi-Channel CMUT Gas Sensor." Journal of Microelectromechanical Systems, vol. 34, no. 1, pp. 4-14, Feb. 2025

Interested in this expertise?

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