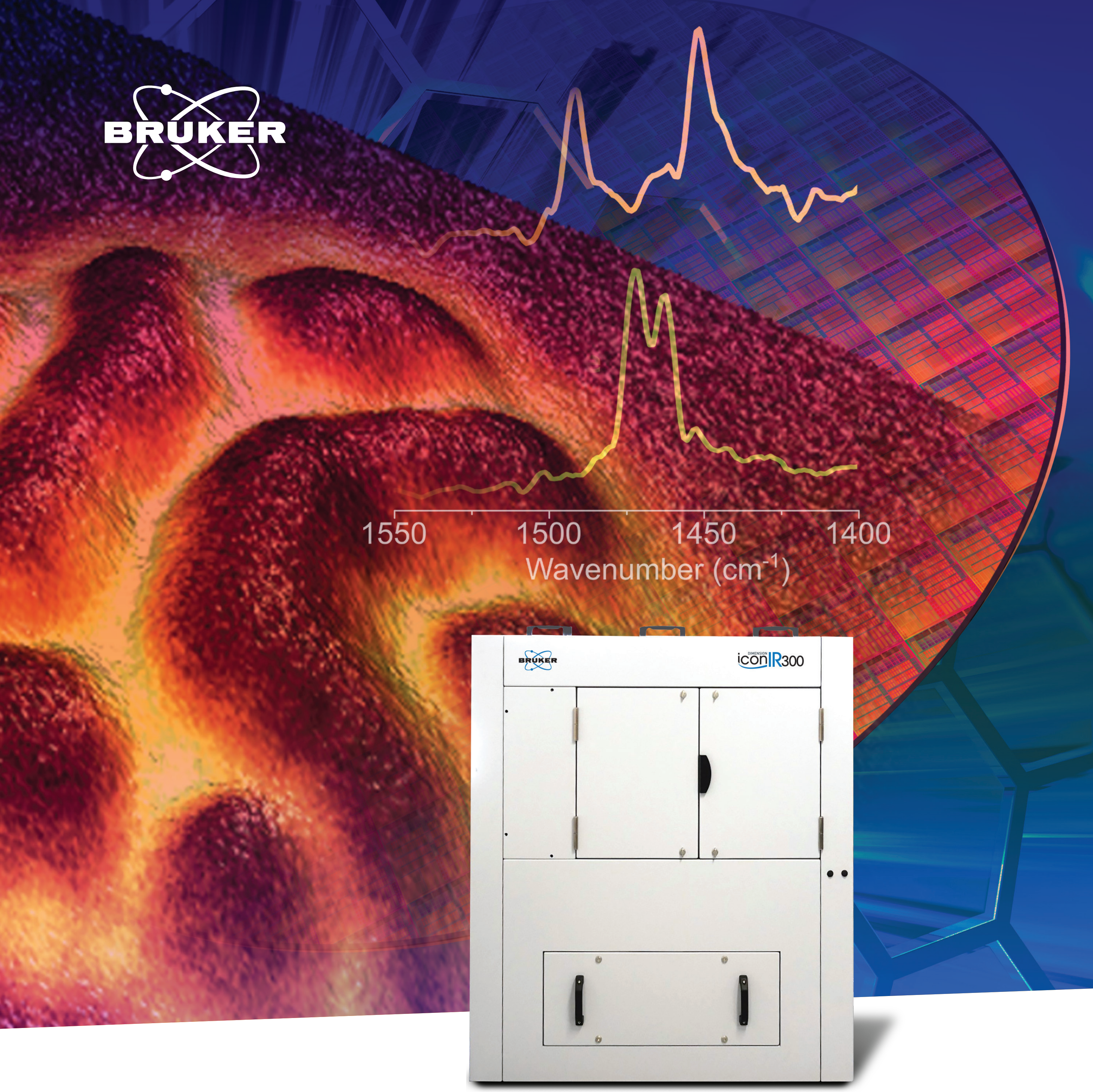


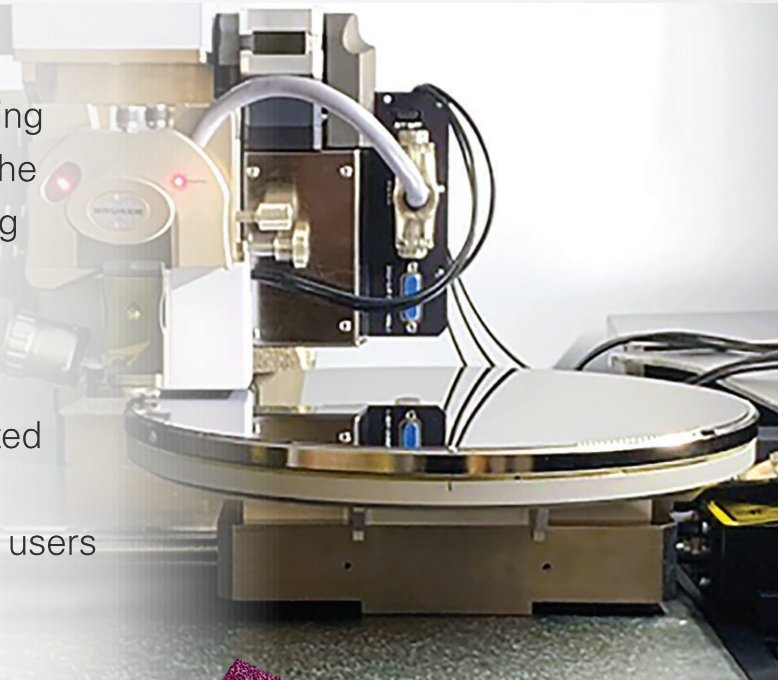
NANOSCALE INFRARED SPECTROSCOPY

Dimension IconIR300

High-Performance Nanoscale IR Spectroscopy, Chemical Imaging and Material Property Mapping for 300 mm Wafers

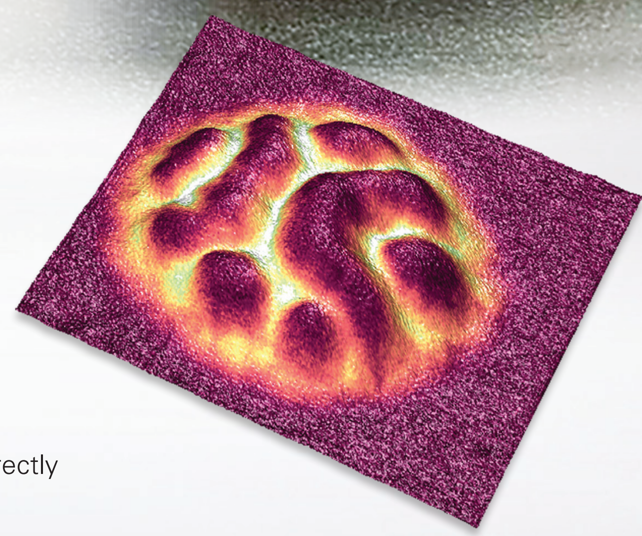
Nanochemical Measurement Capabilities for Semiconductor Defect Characterization

The Dimension IconIR300 large-sample nanoscale IR spectroscopy system extends Bruker's proprietary photothermal AFM-IR technology to support whole-wafer measurement of 200 mm and 300 mm wafers, while retaining the industry-leading atomic force microscopy capabilities of the Dimension Icon® AFM platform, including Bruker's proprietary PeakForce Tapping® property mapping modes. By combining industry-best automated AFM and nanoscale property mapping with patented photothermal AFM-IR spectroscopy and imaging capabilities, IconIR300 provides users with the highest performance nanoscale IR spectroscopy and imaging system for semiconductor applications.



Only the Dimension IconIR300 system provides:

- 300 mm whole-wafer access for non-destructive, automated atomic force microscopy and nanoscale IR spectroscopy and imaging
- Photothermal AFM-IR to uniquely and unambiguously identify organic and inorganic nano-contaminants on semiconductor wafers and photomasks with IR data directly correlating to FTIR libraries
- Non-destructive step-height measurement and nanoscale material property mapping
- Automated recipe-based measurements and KLARF file support for user-friendly access to comprehensive data



High-resolution chemical imaging of PS-b-PMMA block copolymer in Tapping AFM-IR mode. Compositional image shows sample topography and IR image at $1730 cm^{-1}$.

Highest Performance Nanoscale IR Spectroscopy

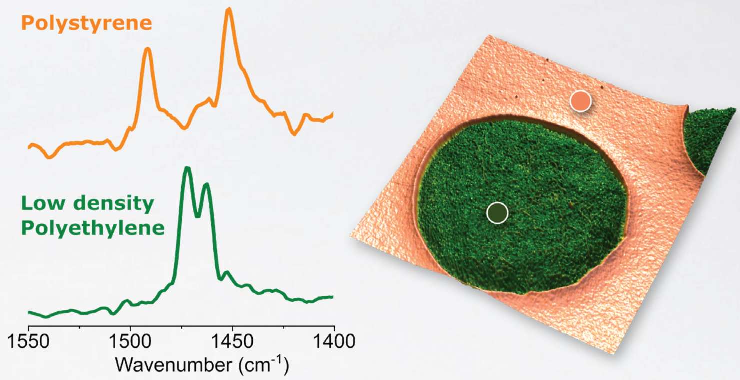
Bruker is the innovator for photothermal AFM-IR-based spectroscopy with our patented, unique suite of several AFM-IR modes. These modes enable IconIR300 to acquire high-speed, high-performance IR spectra that correlate to FTIR spectroscopy. The variety of advanced modes support the measurement of a wide range of samples for both industrial and academic users.

Dimension IconIR300 provides high-performance, rich, detailed IR spectra with FTIR correlation, enabling nanometer-scale measurement of thin contaminants. Additionally, Surface Sensitive AFM-IR mode uniquely provides reliable surface-sensitive chemical measurements for polymeric films. Bruker's AFM-IR spectroscopy is the preferred technique for the nanoIR community and the leading nanoIR mode in semiconductor applications.

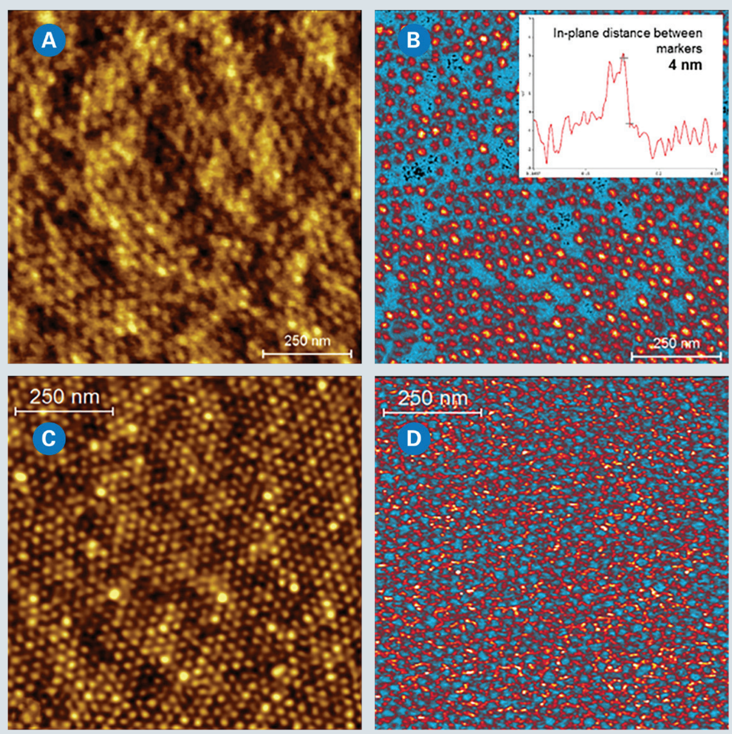
Highest Resolution Chemical Imaging

The Dimension IconIR300's industry-leading AFM performance and Bruker's patented Tapping AFM-IR imaging together enhance the spatial resolution and sample accessibility of our nanoIR technology, extending its application to segments not currently addressed by the photothermal AFM-IR technique.

Dimension IconIR300 provides unrivalled chemical spatial resolution for imaging over a broad range of sample types, including soft organic and inorganic contaminants with consistent, reliable, and high-quality data. Bruker's AFM-IR technology removes any and all mechanical artifacts, ensuring only true chemical composition is collected.



High-quality resonance-enhanced AFM-IR spectra collected at different sites on a PS-LDPE polymer blend, illustrating a high degree of material sensitivity and deeper insight into nanoscale chemical properties.



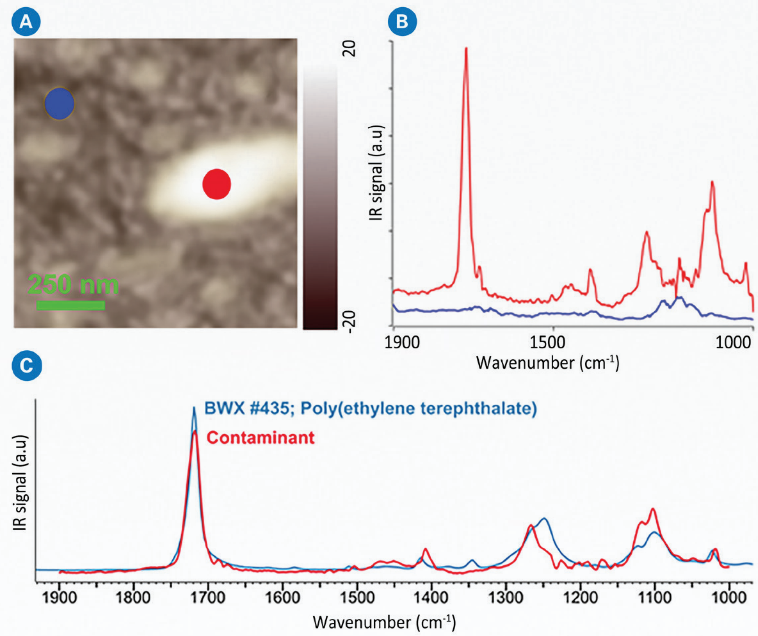
Tapping mode height images with PS-b-PMMA (a); and PS-b-P4VP directed self-assemblies (c). The nanopatterns are spherical with 10-20 nm domains. Tapping AFM-IR image at 1730 cm^{-1} highlights PMMA beads embedded in the polystyrene matrix (b). The ratio image at 1492 cm^{-1}/1598 cm^{-1} illustrates distribution of PS relative to P4VP in the patterned wafer (d). The inset in (b) shows the IR intensity variation along the white dashed line in the main panel. A spatial resolution of 4 nm is observed.

Automated Chemical Identification of Defects

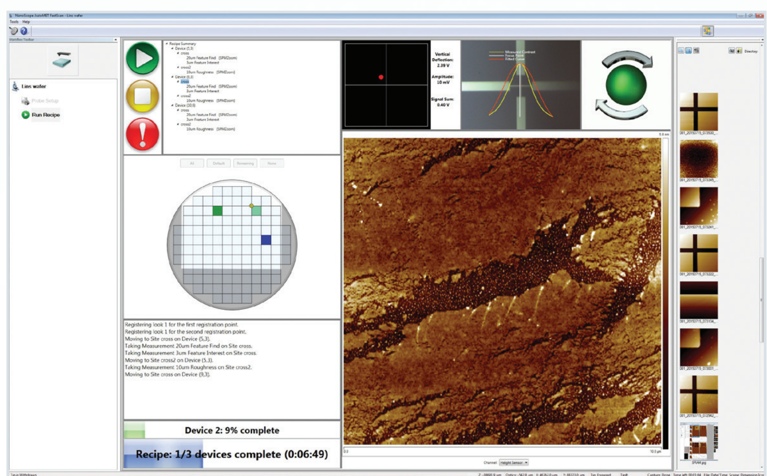
Organic and inorganic nano-contaminants are a common defect type in microelectronics manufacturing processes, including patterned wafers, bare wafers, photomasks, and data storage media wafers. For example, traditional technology generally is capable of only off-line, destructive measurements of bare wafers and is often unable to provide chemical identification of thin organic and inorganic contaminants. IconIR300 resolves this problem by performing automated measurement of organic and inorganic contaminants while providing nanoscale chemical characterization with highly resolved IR spectra that directly correlate to FTIR spectroscopy.

The system provides multiple levels of automation capabilities through AutoMET® software. AutoMET features recipe-based AFM measurements for step height investigations along with nanoscale material property mapping. This proprietary software suite allows automated measurements on multiple samples or a single large sample for nanoscale characterization across multiple locations. It also provides optical and AFM image pattern recognition, tip-centering, full wafer or grid mapping support, and image-placement accuracy within tens of nanometers. Comprehensive, yet simple recipe writing gives real-time and offline operation for advanced users.

IconIR300 also supports KLARF file import capability to enable automated measurement of defects, both organic and inorganic, referencing the defect coordinates acquired in other metrology tools. KLARF file import is supported on photomasks and wafers.



Height image (a) and resulting photothermal AFM-IR spectra (b) from a contaminant on a bare silicon wafer. The resulting match from the FTIR library identifies the contaminant as polyethylene terephthalate.



Recipe window showing wafer-based layout for precise, user-defined X,Y measurement locations within a wafer.

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