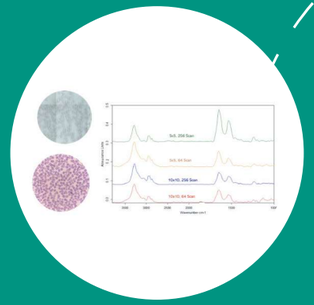
μIR

KEY APPLICATION

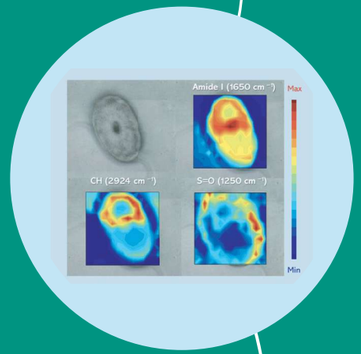


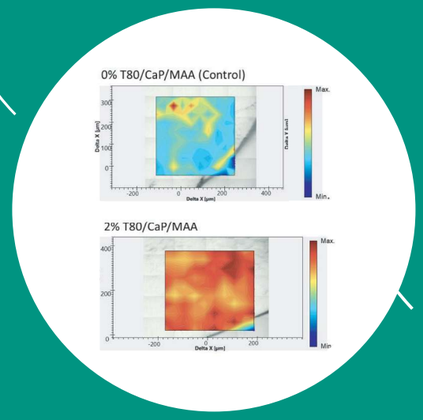
Unmatched Cellular Resolution: The 5×5 Micron Advantage

This data illustrates the defining advantage of Synchrotron light: Brilliance. The image on left side demonstrates that SR-μFTIR delivers chemical fingerprints even at 5×5 micrometers.

Probing Biological Structure: Hair Analysis

SR-μFTIR allows researchers to visualize the internal chemistry of biological fibers with micrometer precision. In this cross-section of human hair, the technique distinguishes between the protein-rich cortex (Amide I map) and the lipid-rich cuticle (CH map). The Sulfoxide map (S=O) is particularly valuable for cosmetic and forensic science, as it reveals oxidative stress and structural damage within the sulfur-rich keratin matrix that is invisible to the naked eye.





Visualizing the Cure: Mapping Bioactive Fillers

This SR-μFTIR chemical map selectively isolates the spectral signature of Amorphous Calcium Phosphate (ACP) nanofillers within a dental adhesive. By distinguishing the phosphate groups (PO_4^{3-}) from the surrounding polymer matrix, the image verifies a uniform dispersion of bioactive agents. This homogeneity is essential for ensuring consistent ion release, which aids in remineralizing tooth structure and preventing secondary caries. [doi:10.4012/dmj.2024-285]

Biomedical Insights

Conduct label-free chemical mapping of individual cells and tissues. Identify microorganisms like algae and yeast and quantify the biochemical impact of pharmaceuticals on living systems.

Agri-Food Innovation

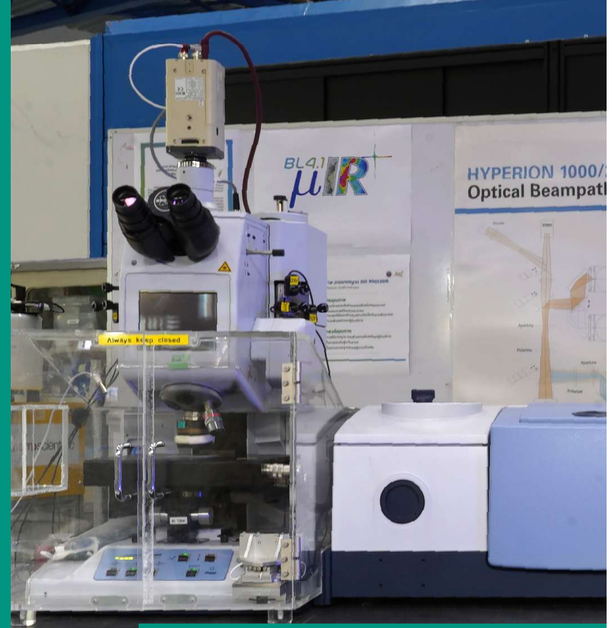
Analyze the molecular makeup of processed foods and identify contaminants or toxins at trace levels to ensure product safety and regulatory compliance.

Advanced Materials

Map and characterize the internal structure of polymers, powders, and multi-layered composites. Reveal hidden interfaces and heterogeneities in thin films to optimize material performance.

Heritage Science

Perform non-destructive chemical mapping of minerals and archaeological artifacts. Track ex-situ chemical alterations in samples subjected to extreme environmental pressures.



FOURIER TRANSFORM INFRARED MICROSPECTROSCOPY (μIR)

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(PUBLIC ORGANIZATION)

PRINCIPLE INFORMATION

Synchrotron-based Fourier transform infrared (SR-μFTIR) microspectroscopy redefines the limits of chemical mapping by coupling the analytical power of infrared spectroscopy with the extreme brilliance of synchrotron light. Unlike conventional thermal sources, synchrotron radiation provides a highly collimated photon beam effectively 1,000 times brighter than a standard instrument.

This capability allows researchers to focus light onto microscopic samples with diffraction-limited spatial resolution while maintaining an exceptional Signal-to-Noise Ratio (SNR). The result is high-definition chemical mapping at the micrometer scale, revealing fundamental vibrational transitions and molecular fingerprints with unparalleled clarity.

TECHNICAL SPECIFICATION

Category	Specification
Beamline	BL4.1: μIR
Photon Energy Range	0.05 – 0.5 eV (4,000 – 400 cm^{-1} wavenumber)
Photon Flux (Full beam)	2.25 x 10^{13} ph/s/0.1% bw
Beam Size	5 – 20 μm² (diffraction limited)
Detectors	• 100 μm Narrow band MCT (10,000 – 780 cm^{-1}) • 100 μm Wide band MCT (12,000 –600 cm^{-1})
Sample Environment	• Dry air purged chamber • Diamond Compression Cell • Microfluidic Cell • Heatable Sample Holder (30 – 100 °C) • IR Polarizer

μIR END STATION



SDGs SUPPORT



SR-μFTIR develops resilient crops, reducing crop-failure risks.



SR-μFTIR enhances food nutrition and safety through biofortification and early disease detection.



SR-μFTIR enables early disease detection and targeted therapies.



Synchrotron facilities develop the next generation of STEM talent.



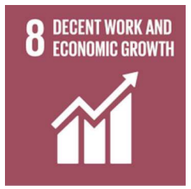
Synchrotron facilities advance gender equality in STEM.



SR-μFTIR supports clean water through microplastic and contaminant detection.



SR-μFTIR advances safer and more efficient energy storage.



SR-μFTIR drives industrial innovation and economic growth.



SR-μFTIR advances durable and sustainable infrastructure.



Synchrotron facilities promote equitable access to advanced research.



SR-μFTIR supports cultural heritage preservation.



SR-μFTIR supports green chemistry and the circular economy.



SR-μFTIR supports dlimate research and climate change mitigation.



SR-μFTIR supports marine ecosystem protection.



SR-μFTIR supports sustainable land management and ecosystem restoration.



SR-μFTIR supports forensic investigations and justice.



SR-μFTIR strengthens global scientific partnerships.