厦门大学 XIAMEN UNIVERSITY

IKKEM 嘉庚创新实验室

Jayitec 嘉仪科技



Smart Raman
Intelligent Raman Microscope

www.ikkem-jiayi.com

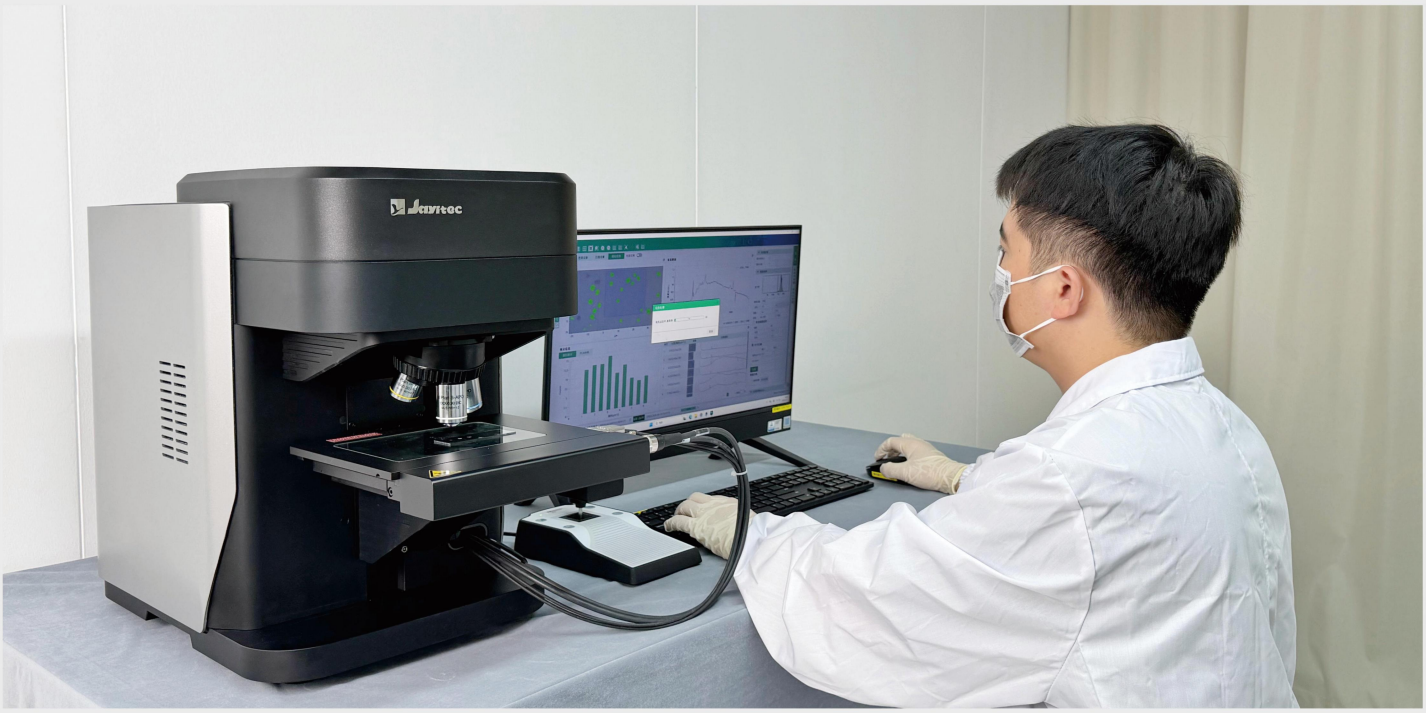
JAYITEC

Smart Raman

- Next-Generation Raman Microscope Platform

The Jayitec Smart Raman intelligent Raman microscope is built upon the strong academic heritage and decades of engineering expertise of Xiamen University in the field of Raman spectroscopy. As a long-standing leader in surface-enhanced Raman spectroscopy (SERS), tip-enhanced Raman spectroscopy (TERS), and advanced Raman instrumentation development, Xiamen University has played a key role in advancing the field. Smart Raman represents the culmination of this technological legacy, integrating world-class Raman spectroscopy expertise with intelligent instrument design. With extensive experience in Raman microscope engineering, the system sets a new benchmark for intelligent Raman microscopy in terms of spatial resolution, spectral resolution, acquisition speed, and detection sensitivity, enabling it to meet the evolving research needs of materials science, biomedical research, forensic science, environmental monitoring, and other advanced application fields.

Smart Raman



Integration in One, Simplified by Design

The system overcomes the limitations of traditional Raman microscopes, including external optical paths, complex fiber connections, and bulky architectures, through a fully integrated design that combines the microscope spectroscopy module and high-precision spectrometer into a single platform. This eliminates external fiber coupling, resulting in a compact, space-saving system that can be easily installed inside glove boxes for more flexible experimental setup and laboratory layout.

1 Laser

Supports 532 nm / 633 nm / 785 nm laser excitation.

5 Objective

5-position motorized turret with standard 10X / 50X / 100X objectives.



2 Microscope

Upright reflected-light microscope with LED bright-field illumination and 8MP camera.

3 Measuring stage

High-precision XYZ measuring stage with autofocus and mapping capabilities. Multiple stage configurations available.

4 Integrated Design

All-in-one compact system, glove-box compatible.

*Dimensions: 33*62*48 cm*

6 Electrochemical Option

Optional in-situ EC–Raman module for synchronized electrochemical and Raman measurements (sub-100 ns synchronization).

Raman Spectrometer Family

1 HD vision

Featuring a high-definition imaging system, the instrument is equipped with an 8-megapixel high-resolution color camera and a professional-grade LED bright-field illumination system. It delivers highly realistic and finely detailed visualization of sample surfaces, enabling smooth and efficient observation from target locating to micro-region identification, ensuring a seamless and responsive imaging experience.

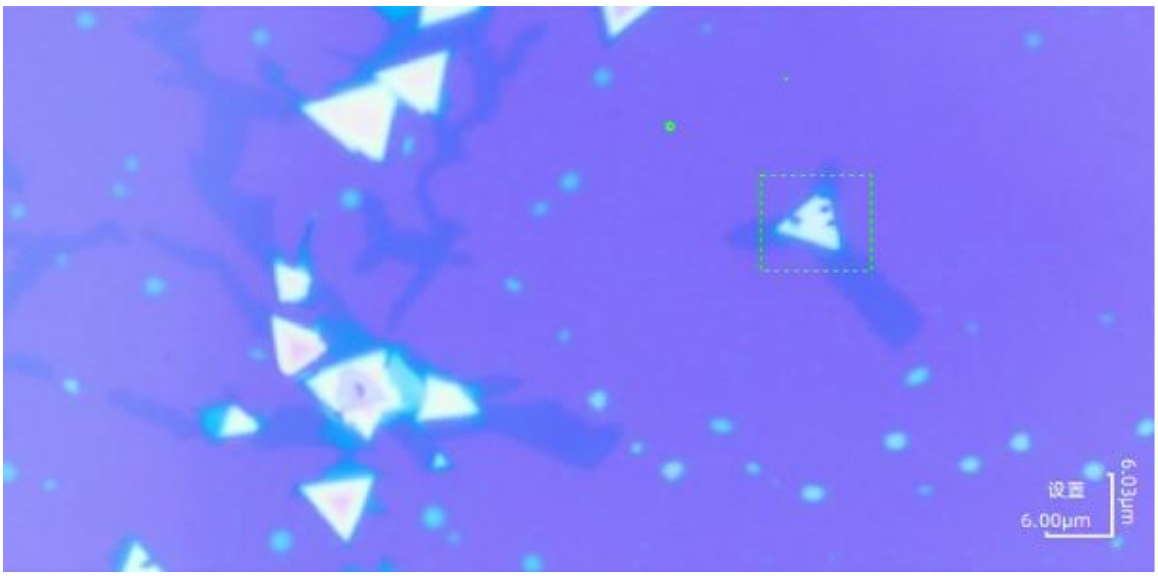


Figure: Microscopic imaging of 2D materials

2 Automated Positioning

Equipped with a high-precision motorized stage, the system offers flexible configuration options ranging from entry-level setups to ultra-high-precision closed-loop stages. Whether performing large-area scanning or precise targeting of micro-scale particles down to 1 μm, the stage responds with extremely high repeatability and accuracy, ensuring reliable and precise execution of every movement command.

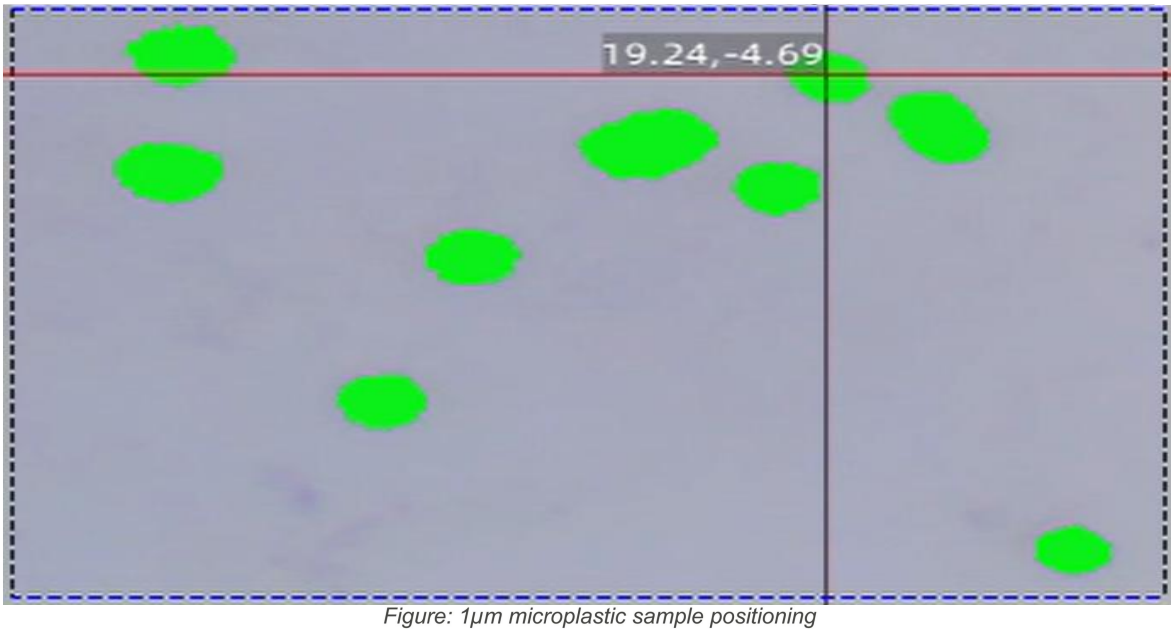


Figure: 1μm microplastic sample positioning

3 Automatic Focusing

Equipped with an intelligent autofocus algorithm, the system is capable of achieving automatic focusing even when the objective is completely out of focus, with a defocus distance of ≥10 mm.

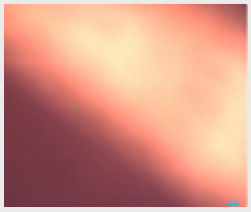


Figure: Defocus

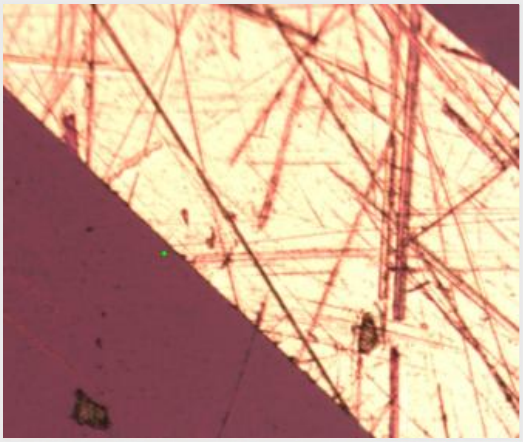


Figure: Focus

4 Fully Automated Mapping Imaging

While a single-point Raman spectrum answers the question "what is this," Raman mapping reveals "where the components are and how they are distributed."
By simply defining the scan area, the system automatically performs the entire workflow, including spectral acquisition, image reconstruction, and data analysis. It enables clear visualization of chemical composition distribution in micro-scale samples.



Figure: Scan area selection

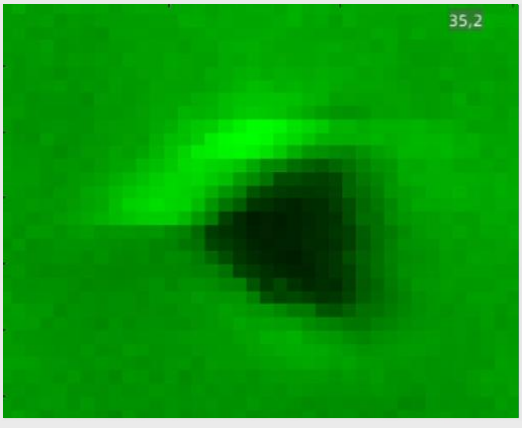


Figure: Mapping acquisition

Powerful Raman Software

One Interface, Full Workflow Control

The software is highly integrated, featuring particle recognition functionality, while also supporting optional electrochemical–Raman coupling capabilities for significantly expanded application potential.

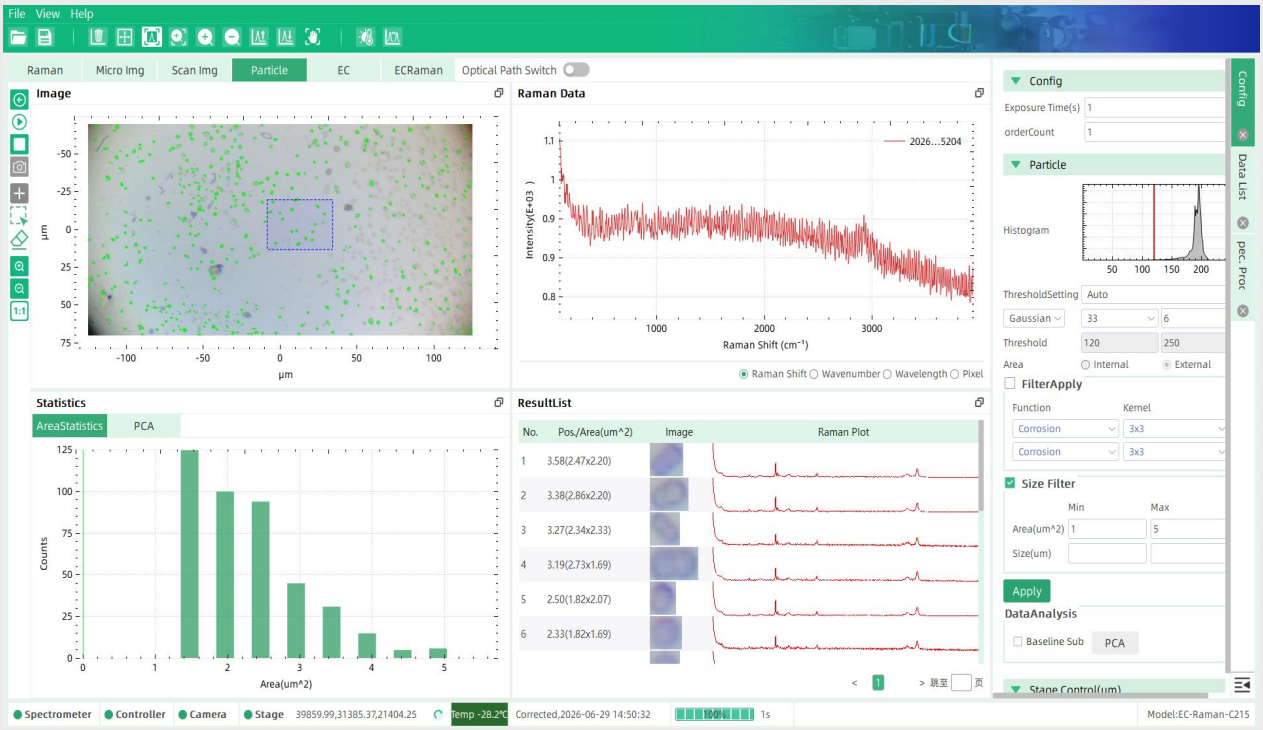
1.Smart Platform Control – Unified Operation, Seamless Workflow

The software integrates Raman spectroscopy, microscopic imaging, scanning imaging, particle detection, and data analysis within a single platform, eliminating the need to switch between multiple software systems. All experimental processes are centrally controlled with real-time data synchronization, ensuring a smooth and efficient user experience.



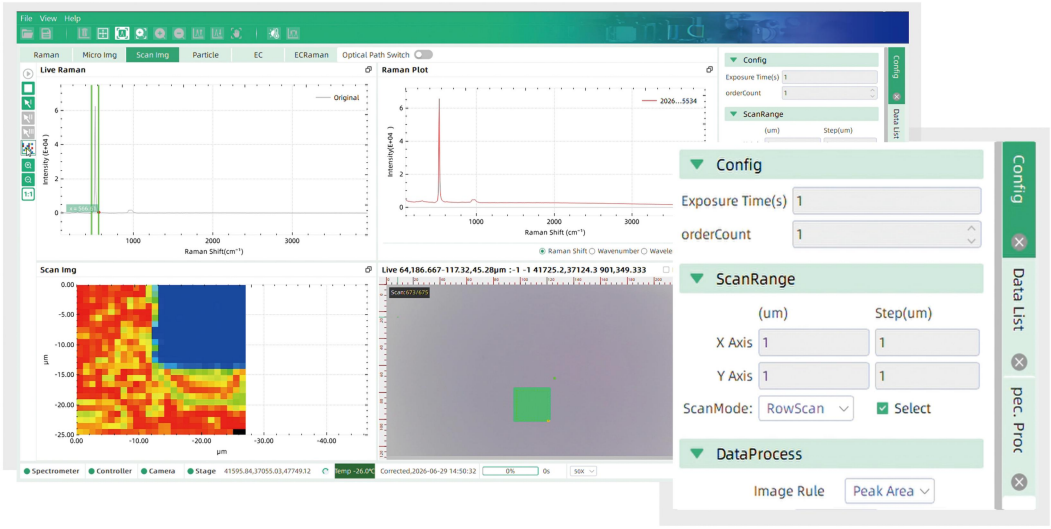
2.Smart Particle Analysis – One-Click Automated Processing

The particle detection module transforms complex manual operations into an automated workflow. It employs a three-level recognition strategy combining adaptive thresholding, morphological filtering, and size-based selection, enabling automatic particle identification and batch spectral acquisition.



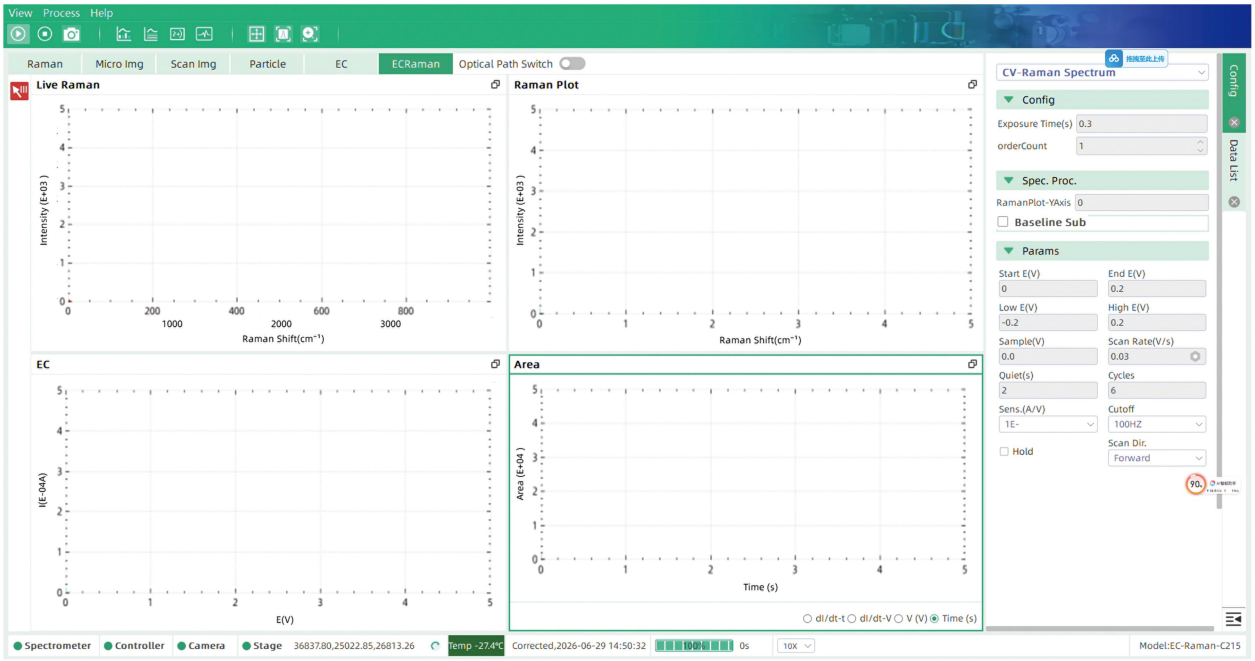
3.Traceable Data Management – Reliable and Reproducible Research

The system provides comprehensive data traceability, supporting import, export, editing, deletion, and storage management functions. This ensures full reproducibility of experiments and well-organized data handling throughout the research process.



4.Raman–Electrochemical Coupling (Optional) – Advanced In-situ Analysis

The optional Raman–electrochemical coupling module enables synchronized acquisition and real-time visualization of Raman and electrochemical signals within a unified interface. It allows dynamic monitoring of molecular structural evolution and the formation and disappearance of species at the electrode interface.



Application Scenarios

Materials Science Frontiers

Smart Raman leverages its high spatial resolution and stable optical path system to enable rapid and non-destructive spectral imaging analysis of 2D materials. It can effectively characterize interlayer coupling, structural uniformity, and defect distribution, serving as a powerful tool for revealing their intrinsic physical properties.

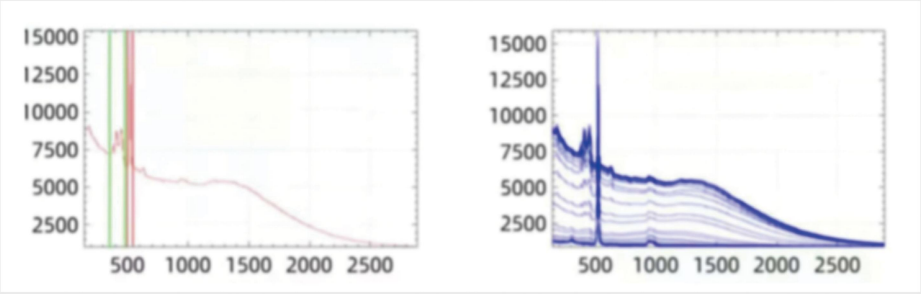


Figure: Real-time Raman spectra of a single pixel and spectra from all pixels of MoS_2

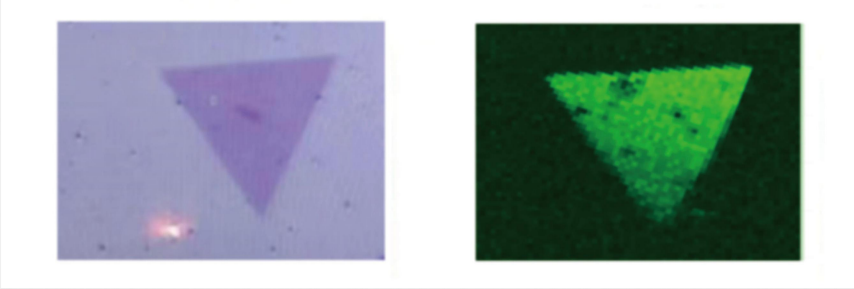


Figure: Microscopic image and Raman mapping image of MoS_2

The system simultaneously acquires Raman signals from the in-plane vibrational mode E_2g (≈387 cm^{-1}) and the out-of-plane vibrational mode A_1g (≈405 cm^{-1}). Based on the spatial intensity distribution differences between these two signals, it can reconstruct high-resolution Raman imaging in real time.

Each pixel in the resulting image reflects differences in color intensity corresponding to the material's spatial distribution, structural uniformity, and potential defect regions.

For rapid and non-destructive layer number identification, the peak separation (A) between A_1g and E_2g modes is calculated. When A falls precisely within the range of 17–20 cm^{-1}, the region can be identified as a monolayer structure, enabling fast and reliable thickness determination.

Environmental Monitoring

Microplastic particles as small as 1 μm are traditionally identified through time-consuming manual microscope screening and individual spectral acquisition, with limited efficiency and reproducibility. Smart Raman integrates an intelligent particle recognition algorithm that enables automatic localization of microplastic particles and batch acquisition of Raman spectra for each particle. The software simultaneously generates statistical reports, including particle count, size distribution, and composition ratios, allowing clear visualization of microplastic distribution and source analysis.

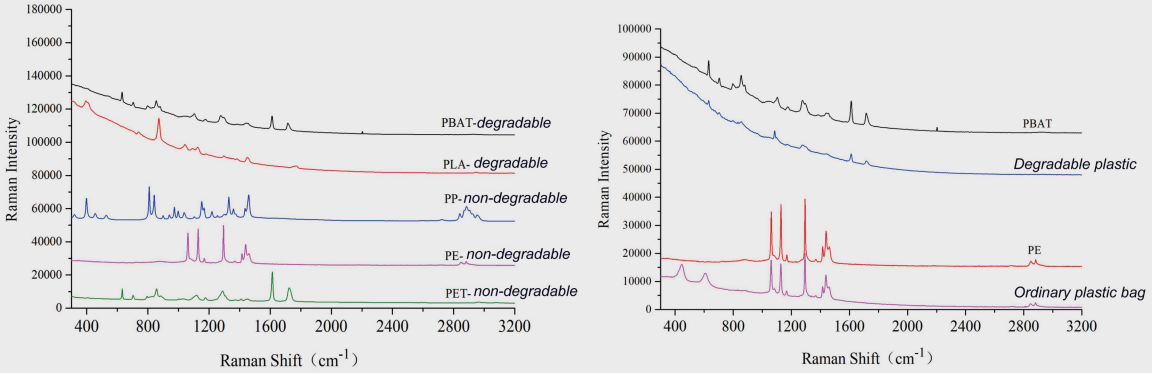


Figure: Comparison of PE and PBAT microplastic detection

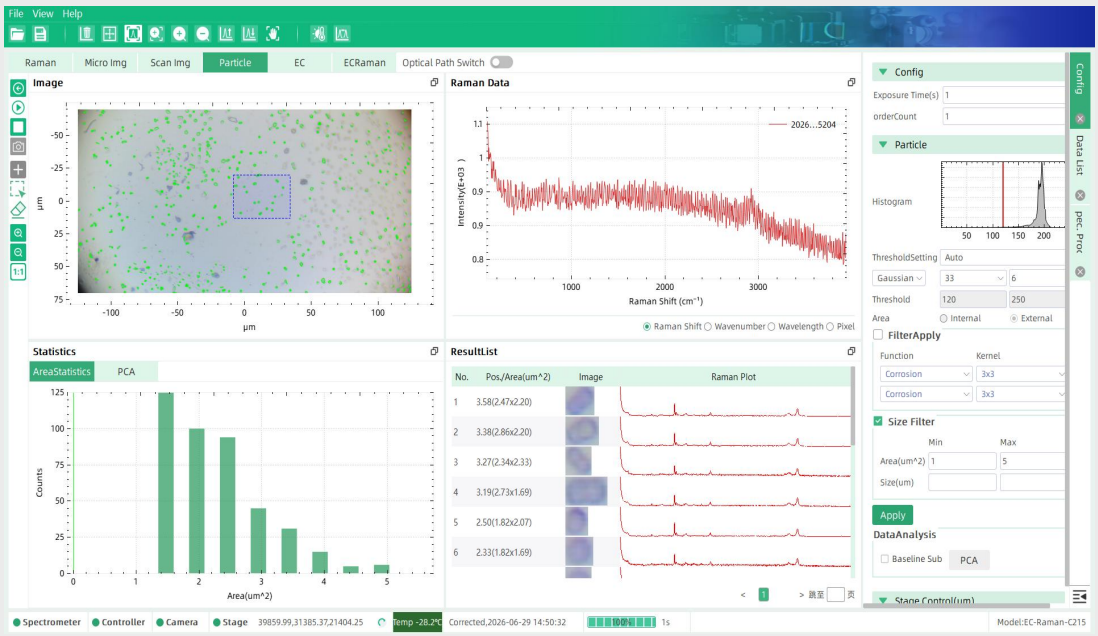


Figure: Batch microplastic detection using particle recognition

Application Scenarios

Biomedical Exploration

Without the need for complex fluorescence staining or antibody labeling, the intrinsic "molecular fingerprint" capability of Raman spectroscopy enables direct qualitative analysis of tissue sections, single cells, and even pathogenic microorganisms. This is crucial for preserving the native state of samples and avoiding interference from labeling agents.
Combined with the SERS technology developed by the Xiamen University, Smart Raman enables highly sensitive detection of trace substances in complex biological matrices such as blood. This provides a new spectroscopic perspective for early diagnosis, pathological mechanism research, and drug delivery monitoring.

Pharmaceutical Analysis
• No sample pretreatment required, enabling non-destructive detection.
• Clear differentiation of characteristic peaks among different drugs.

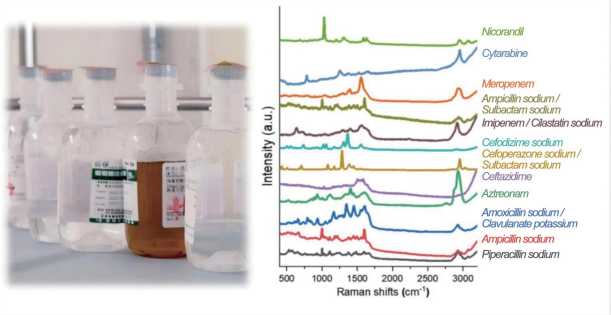


Figure: Raman spectra of different pharmaceuticals

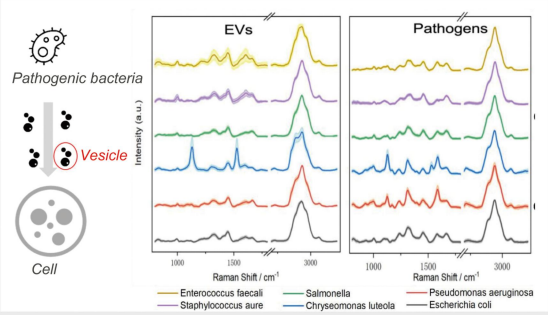


Figure: Pathogen and vesicle detection

Pathogen and Vesicle Detection
• Fast detection speed.
• Captures key features including species, response, function, and activity.

Blood Toxic Substance Detection
• SERS-based solution.
• Detection covers common drugs of abuse, new psychoactive substances, highly toxic pesticides, sedative-hypnotic drugs, and other hazardous compounds in blood.

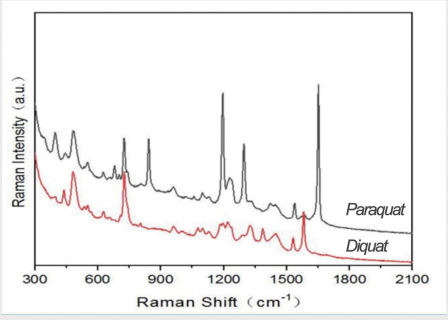


Figure: Detection of paraquat and diquat in blood

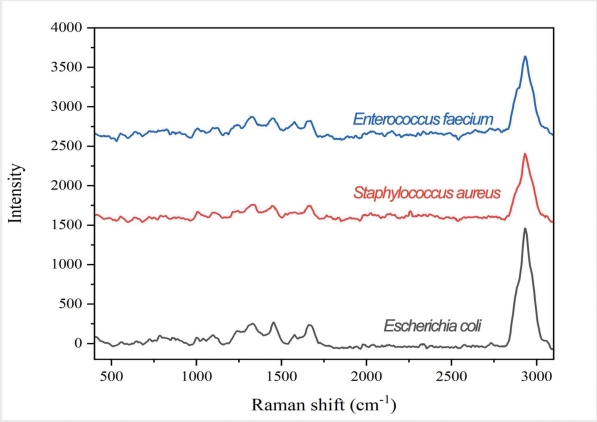


Figure: Raman spectra of different bacterial species

Rapid Identification of Pathogenic Bacteria Species
Spectral comparison of three representative pathogenic bacteria, including Enterococcus faecium, Staphylococcus aureus, and Escherichia coli, for rapid species identification.

Using Escherichia coli as an example, Raman spectral differences were analyzed between cells cultured in a standard medium (H_2O) and those labeled with heavy water (D_2O). A characteristic D_2O-related spectral region appears in the range of 2040-2300 cm-¹ (as shown in the figure), which can be used for studies on bacterial drug susceptibility.

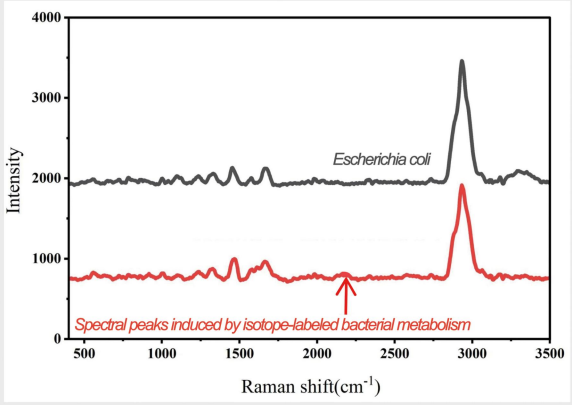


Figure: Raman spectral comparison of Escherichia coli under D_2O labeling

A system specifically designed for microbial identification enables full automation of the entire workflow, from sample collection and pre-treatment to Raman detection, algorithm-based recognition, and final report generation.

— Chinese Academy of Sciences, Institute of Urban Environment

From Smart Raman to EC-Raman

From Intelligent Microscopy to In-situ Electrochemistry

Smart Raman is not only a high-performance intelligent Raman microscope, but also a flexible and expandable open optical spectroscopy platform. When research requirements extend to in-situ electrochemical characterization, the system can be upgraded with optional modules into an integrated EC-Raman electrochemical Raman microscope, covering the full range from conventional Raman analysis to Raman-electrochemical coupling applications.

After upgrade, the system provides enhanced capabilities including real-time synchronized acquisition, where electrochemical signals and Raman spectra are dynamically linked on the same time axis to monitor electrochemical processes in real time. It enables in-situ analytical capability by simultaneously capturing structural evolution and electrochemical behavior during electrocatalysis or corrosion processes, offering dual-dimensional insights into material changes.

Transient electrochemical characterization

Magnetically electrochemical spectroscopic cell

Integrated Raman–microscopy–electrochemistry system

Raman and electrochemical signals are synchronized with nanosecond-level delay performance



Raman Spectrometer Family

Xiamen University has been deeply engaged in Raman spectroscopy research for more than 30 years. The team led by Academician Tian Zhongqun pioneered Shell-Isolated Nanoparticle-Enhanced Raman Spectroscopy (SHINERS), with related achievements published in top journals such as Nature and awarded the Second Prize of the State Natural Science Award.
In September 2019, approved by the Fujian Provincial Government, the Fujian Science & Technology Innovation Laboratory for Energy Materials, also known as Tan Kah Kee Innovation Laboratory, was jointly established by the Xiamen Municipal Government and Xiamen University, with the goal of building a national strategic scientific and technological force in the field of energy materials.
Scientific instrument development is one of the key strategic directions of Tan Kah Kee Innovation Laboratory. On May 6, 2023, Luxiang Jiayi (Xiamen) Technology Co., Ltd. was incubated and established. Leveraging the strong research resources of Xiamen University and Tan Kah Kee Innovation Laboratory, we focus on Raman spectroscopy and electrochemical technologies. Our products cover diverse fields including energy materials, biomedicine, education and scientific research, and industrial inspection. We are committed to becoming a high-tech platform enterprise centered on advanced scientific instrument technologies and products.



EduRaman Pro
Educational Multifunctional Raman Spectrometer
Open optical path · Four-in-one functionality · Comprehensive teaching support



EC-Raman
Integrated Electrochemical Raman Microscope
Glovebox-compatible · Ultimate synchronization of electrochemical and Raman signals · Transient electrochemical Raman characterization technology



MWHR Raman
Confocal Microscopic Raman Spectrometer
Submicron spatial resolution · 3D confocal visualization



Palm/Porta Raman
Handheld/Portable Raman Spectrometer
Suitable for drug control, food safety, environmental monitoring, and pharmaceutical applications · SERS solutions developed by the Xiamen University technical team

JAYITEC

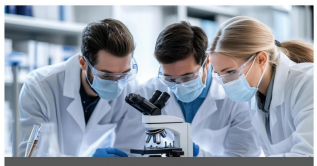
Luxiang Jiayi (Xiamen) Technology Co., Ltd. was established by leveraging the strong research resources of Xiamen University and Tan Kah Kee Innovation Laboratory (IKKEM). We focuses on the development of key technologies in Raman spectroscopy and electrochemistry, and is dedicated to developing high-end specialized instruments for applications in energy materials, biomedicine, industrial inspection, and other fields. We are a high-tech enterprise integrating design, R&D, manufacturing, sales, and service.

Scan to follow

Qualifications & Honors

- *National High-Tech Enterprise*
- *Participant in the National Major Scientific Instrument Development Program under China's 12th Five-Year Plan*

MAIN APPLICATION AREAS

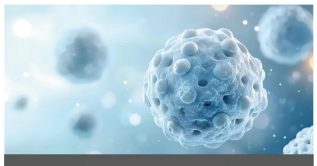

University Education


Scientific Research


Food Safety


Drug Analysis


Environmental Protection


Biomedicine


Chemical Analysis


Pharmaceutical Industry

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Our professional technical consulting team provides dedicated one-on-one guidance and technical support across our full product portfolio.
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