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EduRaman Pro

Educational Multifunctional Raman Spectrometer

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Breaking the “Black Box” - A Conceptual Revolution in Educational Instruments

For a long time, one of the key challenges in instrument-based education has been that most commercial instruments are designed as “black boxes.” Students often find it difficult to understand and master the underlying detection principles of the instrument, and can only build their understanding through operational experiments. Such teaching tends to train “skilled operators” rather than people who truly understand instruments.

From the very beginning, EduRaman Pro has been designed around one core belief: an educational instrument must make principles visible.

EduRaman Pro adopts an open structure that fully presents the laser, grating, detector, and optical path. Students can assemble, adjust, and calibrate the system by themselves, understanding the role of each optical component as if building with blocks. When an instrument is transformed from a “black box” into a “transparent system,” learning moves beyond memorization and becomes true understanding.

Educational Multifunctional Raman Spectrometer



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Product Structure
- Open Optical Path and Modular Configuration

1 Laser

Supports multiple laser wavelengths, including 532 nm, 633 nm, and 785 nm.

2 CCD Detector

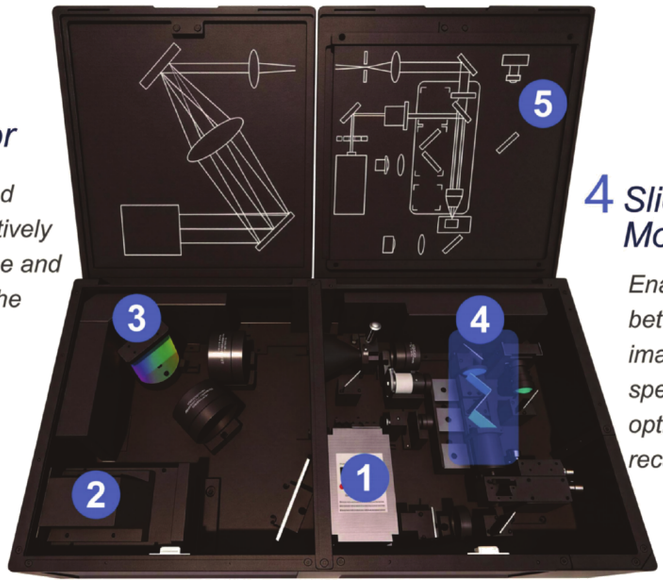
Equipped with a cooled CCD detector to effectively suppress thermal noise and significantly improve the signal-to-noise ratio.

3 Grating

High-density reflective grating with spectral resolution better than 6 cm $^{-1}$.

5 Sliding Cover Plate

The optical path diagram on the cover plate clearly illustrates the working principle of the instrument.



4 Sliding Switching Module

Enables free switching between bright-field imaging and multiple spectroscopic detection optical paths without recalibration.

Dimensions: 52×28×13 (cm)

EduRaman Pro is built with a fully modular design. Key components such as the laser, grating, filters, sample stage, and detector are arranged as independent modules, making the internal structure of the spectrometer clear and easy to understand.

Each module can be used separately for demonstration, or assembled into a complete spectrometer system for hands-on teaching and experiments.

With its open optical path design, students can directly observe the position of each optical component, the direction of light propagation, and the switching process between different modules—without opening or disassembling the instrument.

More Than Raman:Expandable Microscopic Imaging, Absorption Spectroscopy, and Fluorescence Spectroscopy.

Raman spectroscopy is the core standard function of EduRaman Pro, supporting fundamental teaching and research needs such as molecular fingerprint identification and structural analysis. At the same time, users can flexibly select the following expansion modules according to different application scenarios and budgets:

■ *Microscopic Imaging Module*

Enables high-magnification sample observation and "what you see is what you measure" analysis. It is suitable for micro-area analysis and correlated studies of material morphology and composition.

■ *Absorption Spectroscopy Module*

Measures the absorption characteristics of samples at specific wavelengths. It is suitable for experiments such as optical band gap analysis and quantitative concentration analysis.

■ *Fluorescence Spectroscopy Module*

Captures fluorescence signals from samples. It is suitable for advanced topics such as biomarker detection and luminescent material characterization.

Tailored for a wide range of applications
Whether in chemistry, materials science, physics, pharmacy, environmental science, or precision instrumentation, EduRaman Pro can enter your classroom or laboratory with the most suitable configuration.

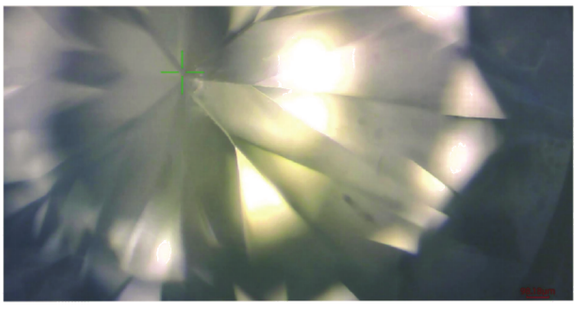


Figure: Microscopic image of a natural diamond

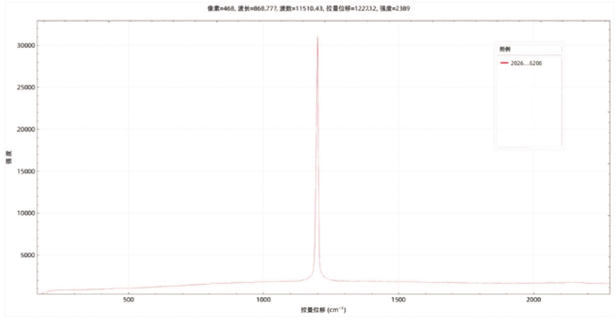


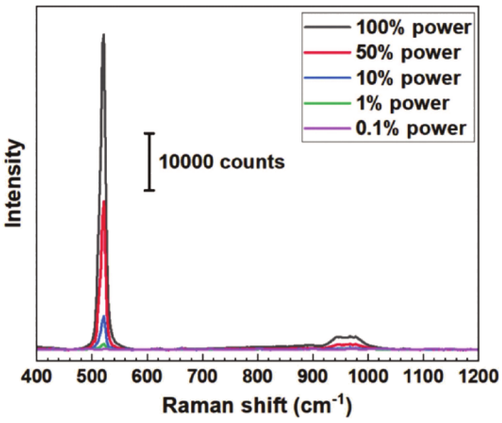
Figure: Raman spectrum of a natural diamond

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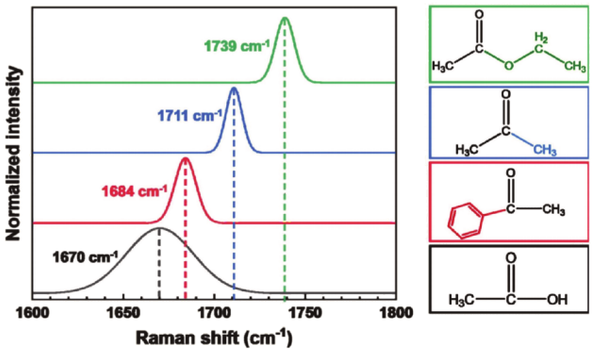
Exploring the Unlimited Possibilities of Raman Spectroscopy

Principle Verification Experiment: Understanding Raman Spectroscopy

Raman spectroscopy is the core standard function of EduRaman Pro, supporting fundamental teaching and research needs such as molecular fingerprint identification and structural analysis. At the same time, users can flexibly select the following expansion modules according to different application scenarios and budgets:



• *Raman spectra under different laser powers: observe how the intensity of characteristic peaks changes and explore the factors that influence Raman peak intensity.*



• *Where do Raman peaks come from? Measure the Raman spectra of standard samples, identify characteristic peaks, and explore the factors that affect Raman peak positions.*

> ***"The first sight of clear Raman peaks, the first true understanding of "fingerprint spectroscopy" — this is where all exploration begins."***
>
> *— Shanghai Jiao Tong University*

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Exploring the Unlimited Possibilities of Raman Spectroscopy

Basic Application Experiments: Mastering Key Raman Applications

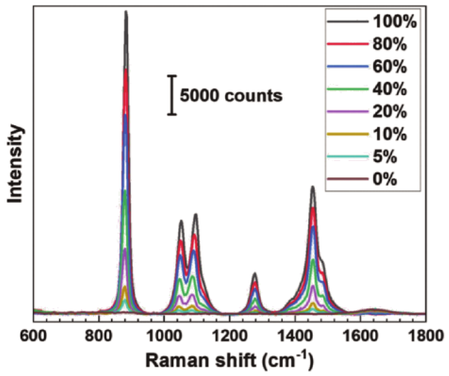


Figure: Raman spectra of ethanol solutions at different concentrations

- ***Quantitative Experiment: Ethanol Concentration Analysis***

As the concentration decreases, the intensity of the characteristic Raman peaks of ethanol decreases in a regular pattern, providing practical training for quantitative analysis.

- ***Qualitative Experiment: Rapid Identification of Natural and Imitation Jadeite***

Typical Raman peaks of jadeite appear at around 377, 700, and 1038 cm^{-1}.
Imitation materials may show no such peaks or display shifted peak positions.

Key Practice Points for Students:

→ Identify the characteristic peaks of natural jadeite.
→ Practice peak-position comparison using standard spectral libraries or literature data.

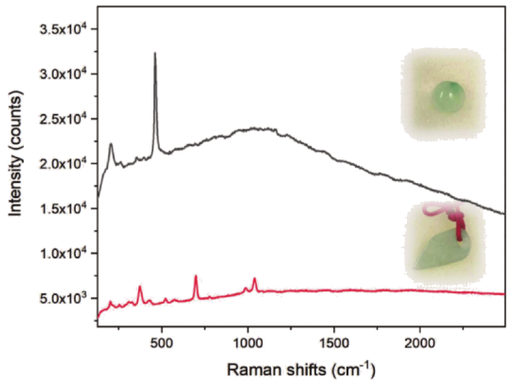


Figure: Raman spectra of natural and imitation jadeite

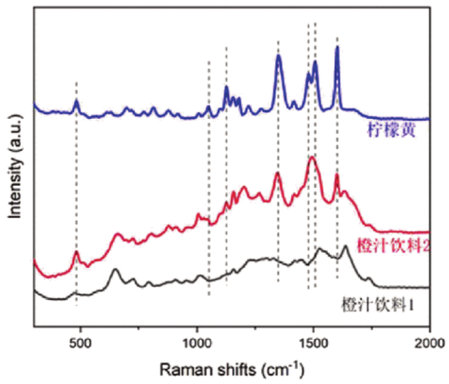


Figure: Raman spectra of pigments in beverages

- ***Qualitative Experiment: Detection of Pigments in Beverages***

Conventional Raman spectroscopy often has difficulty detecting trace synthetic pigments. However, with surface-enhanced Raman spectroscopy (SERS), these pigments can be rapidly identified.

Key Practice Points for Students:

→ Explore preliminary SERS-based detection methods.
→ Understand how SERS helps overcome challenges in trace-level detection.
→ Master characteristic peak comparison and spectral interpretation methods.

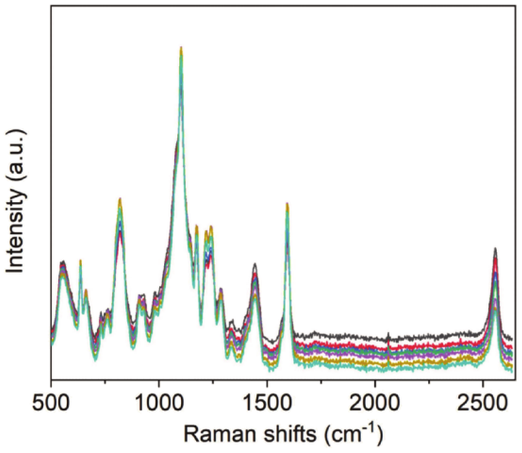
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Exploring the Unlimited Possibilities of Raman Spectroscopy

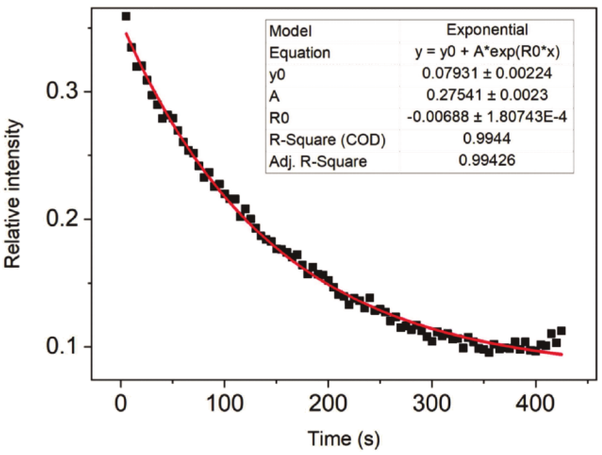
Kinetic Experiment: In Situ Monitoring of Reaction Processes

Kinetic Experiment: Epoxy Resin Curing Reaction

The curing reaction of epoxy resin is a typical chemical kinetic process. The Educational Multifunctional Raman Spectroscopy System enables in situ, real-time, and continuous monitoring of the decrease in the characteristic Raman peak intensity of reactants over time. By fitting the data, the first-order reaction rate constant can be obtained, transforming the abstract concept of "reaction kinetics" into an intuitive change in curves.



• *Monitor the decrease in peak intensity to track the consumption rate of reactants.*



• *Use the built-in kinetic analysis window to generate I–t curves.*

> ***"From using instruments to conducting research — integrated spectroscopic capabilities open the door to real scientific exploration."***
>
> *— University of Chinese Academy of Sciences*

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Exploring the Unlimited Possibilities of Raman Spectroscopy

Comprehensive Exploration Experiment: Integrating Multiple Spectroscopic Techniques

Fluorescence Spectroscopy Experiment:

Using the Educational Multifunctional Raman Spectroscopy System, students can complete a quantitative analysis experiment of resazurin at nanomolar concentrations, gaining a deeper understanding of the linear relationship between fluorescence intensity and concentration, as well as the principles of trace-level detection.

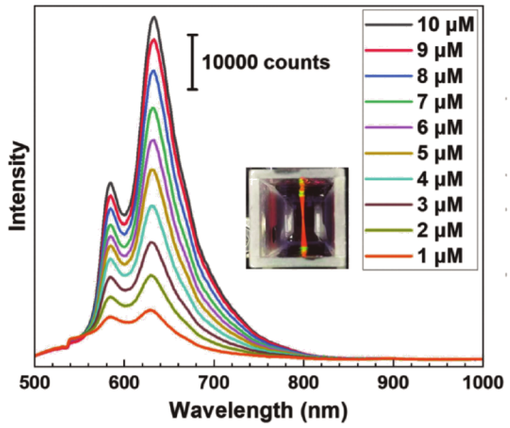


Figure: Fluorescence spectra of resazurin at different concentrations

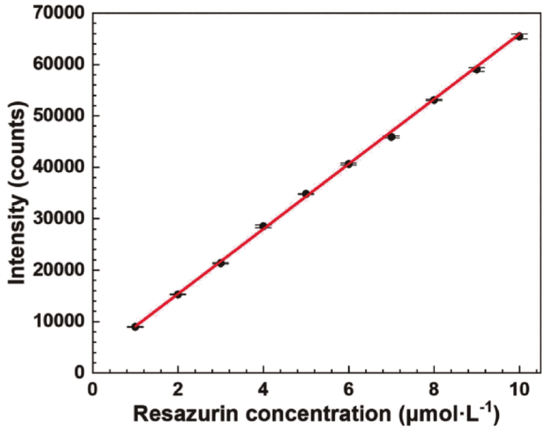


Figure: Calibration curve of resazurin, intensity vs. Concentration

Absorption Spectroscopy Experiment:

Using the Educational Multifunctional Raman Spectroscopy System, students can complete a full UV-Vis absorption spectroscopy measurement experiment, gaining a deeper understanding of the light absorption characteristics of substances and their key role in the analysis of composition, concentration, and reaction processes.

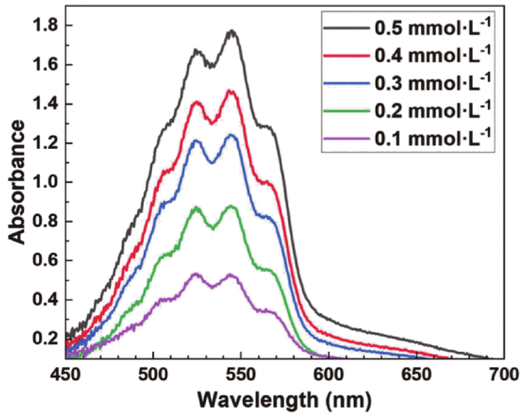


Figure: Absorption spectra of permanganate solutions at different concentrations

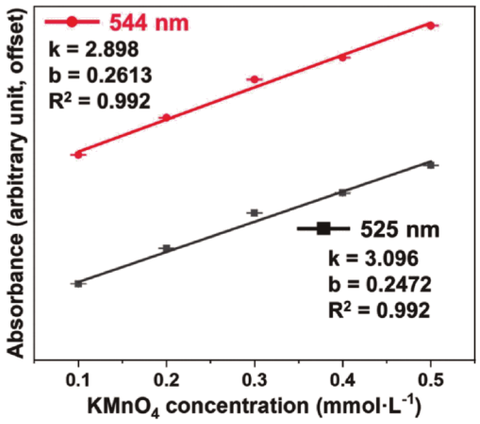


Figure: Linear relationship between absorbance and concentration

Powerful Raman Software

EduRaman Pro Software

EduRaman Pro software is specially designed for educational applications. With an intuitive interface and easy-to-use operation, it enables both students and instructors to get started quickly. The software offers a rich set of functions, integrating bright-field microscopic imaging, Raman spectroscopy, absorption spectroscopy, and fluorescence spectroscopy analysis. It also includes built-in calibration guidance and principle-based teaching plugins, helping students better understand the fundamentals of spectroscopic detection technologies.

1 Intuitive Demonstration of Principles

Clearly demonstrates the principles of wavelength calibration and spectrometer correction, helping users understand the core knowledge behind the instrument.

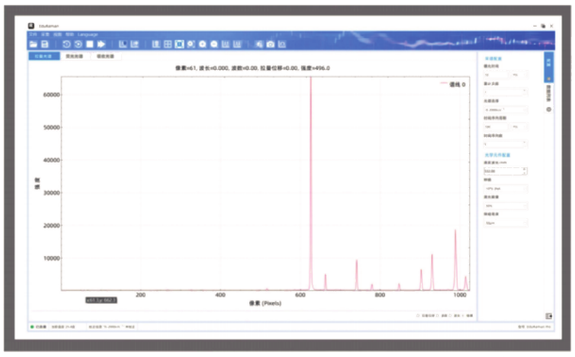


Figure: Raman Spectrum of a Neon Lamp after Wavelength Calibration

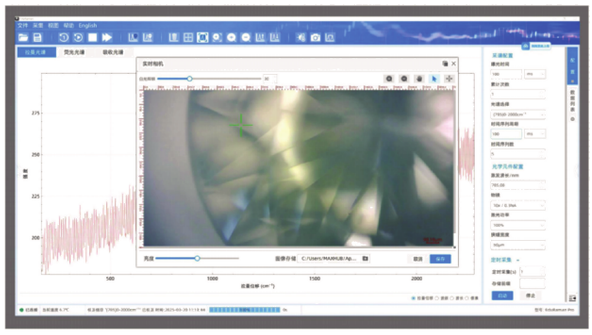


Figure: Microscopic image of diamond

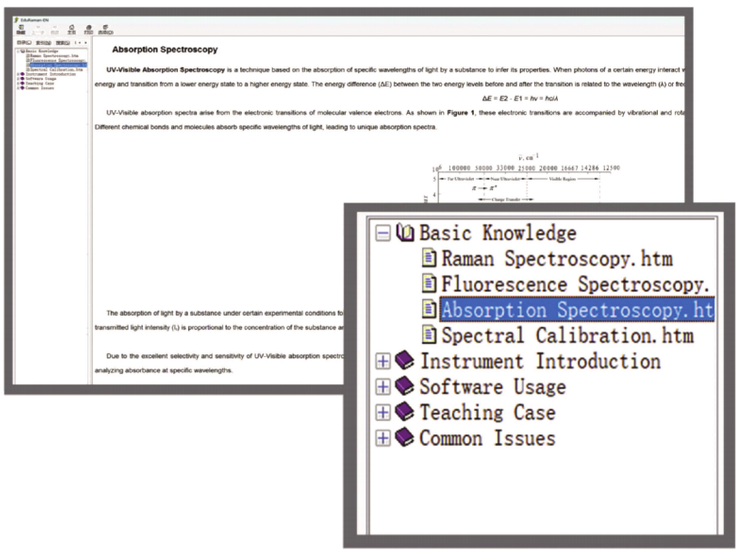
2 Multifunctional Spectral Acquisition and Imaging

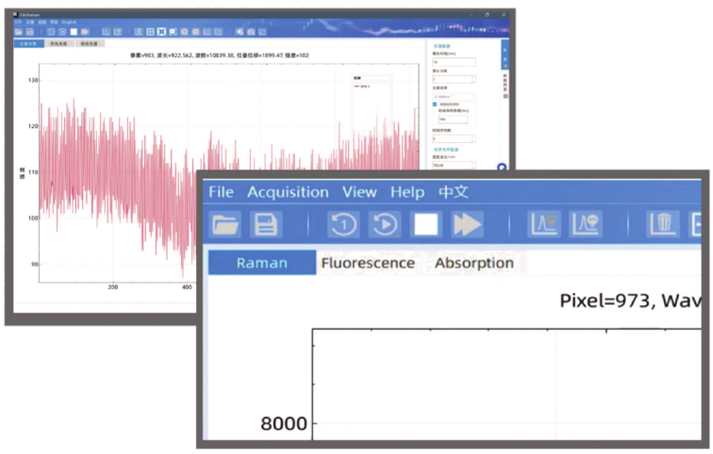
Supports both static and dynamic spectral acquisition, with integrated spectral visualization and microscopic imaging functions to meet diverse teaching and experimental needs.

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3 Built-in Knowledge Search

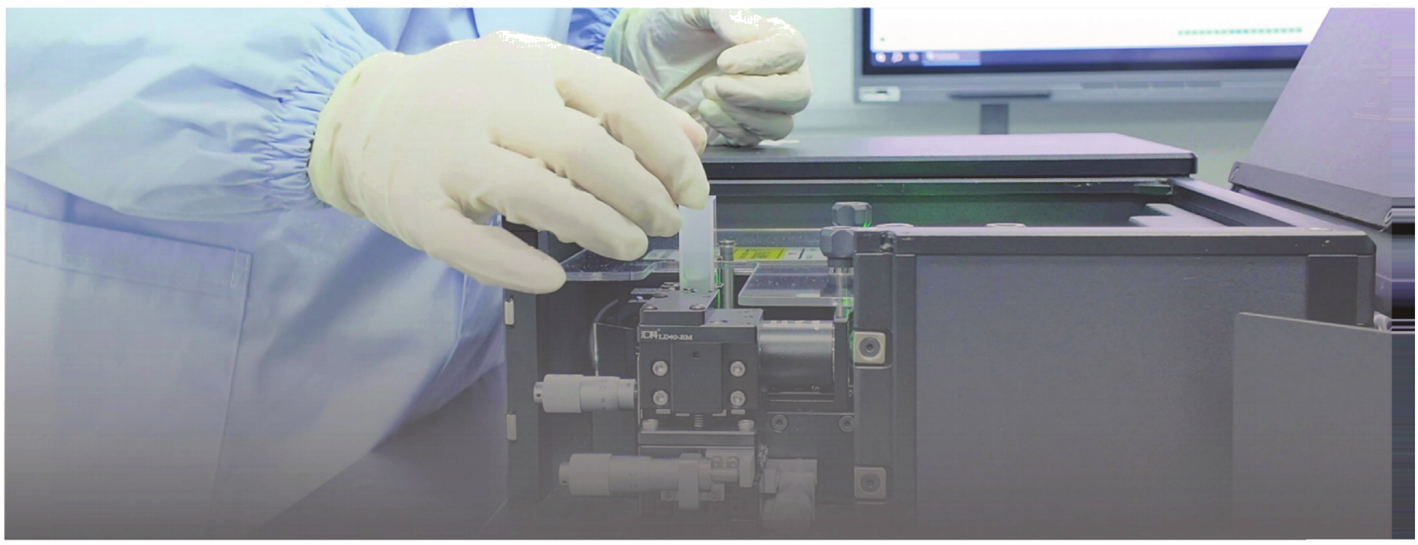
Supports knowledge search, allowing users to quickly access principles, terminology, and operation guides for teaching and self-directed learning.

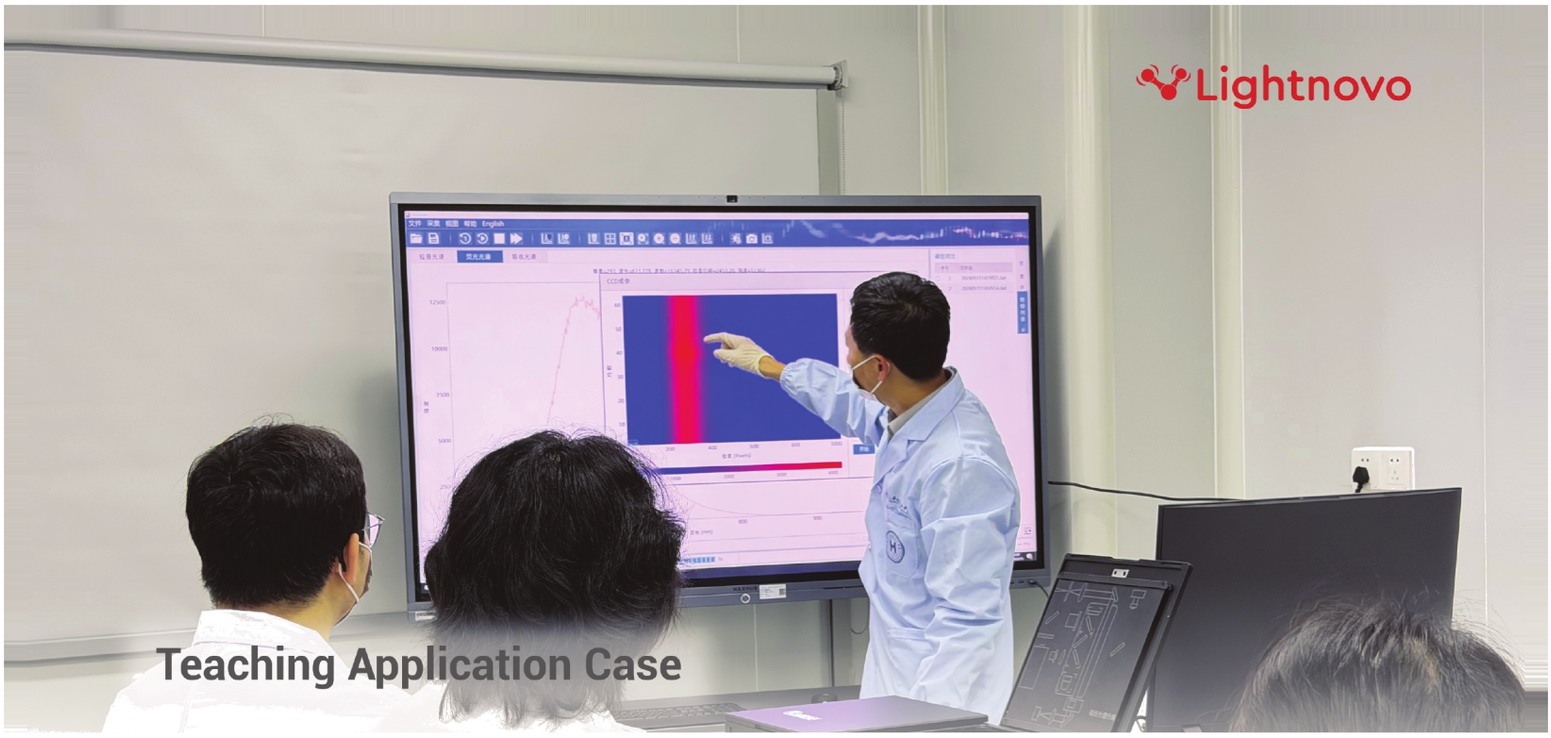




4 One-Click Flexible Switching

Integrates microscopic imaging, Raman spectroscopy, absorption spectroscopy, and fluorescence spectroscopy analysis in one platform, enabling flexible one-click switching between different functions.





Teaching Experiment Design

Based on teaching practice at Xiamen University, the recommended teaching configuration is as follows:
Class size: 20 students per class, 4 students per group, with one instrument per group, using a small-class rotation model
Course duration: Four flexible teaching modes are available: 6 h, 9 h, 12 h, and 18 h
Course content: Covers principle understanding, optical design of the instrument, instrument performance testing, wavelength calibration, and various experiments
Experiment content: Includes principle experiments, qualitative experiments, quantitative experiments, kinetic experiments, comprehensive experiments, and more
Supporting resources: Complete teaching plan

Teaching Course Mode Configuration	Understanding Raman Principles (1 h)	Familiarization with Instrument Optical Design (1 h)	Familiarization with Software-Based Spectral Acquisition(1 h)	Independent Instrument Assembly(6 h)	Instrument Performance Testing(0.5 h)	Wavelength Calibration (1 h)	Experiment Preparation(0.5 h)	Principle Experiment(1 h)	Basic Application Experiment(3 h)	Comprehensive Exploration Experiment(3 h)	Total
Mode I	→	→	→		→	→	→	→			6 h
Mode II	→	→	→		→	→	→	→	→		9 h
Mode III	→	→	→		→	→	→	→	→	→	12h
Mode IV	→	→	→	→	→	→	→	→	→	→	18 h



About Lightnovo

A spin-off from the Technical University of Denmark, Lightnovo was founded in 2019 by an enthusiastic team united by the goal of revolutionizing the field of Raman spectroscopy through innovative, high-performance solutions. Our mission is to develop and commercialize **“Raman for all: democratize the power of high-end Raman spectroscopy for the benefit of mankind”.**

Lightnovo is the official European distributor of EduRaman Pro, providing sales, technical support, training, and local customer service across Europe.

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