

foram[®]3

685nm
785nm

Raman spectrometers specifically designed for the examination of forensic evidence



Fast, non-destructive and highly effective, Raman spectroscopy is an ideal technique for identifying and comparing substances of forensic value.

Unlike other Raman systems, Foram[®]3 spectrometers have been developed specifically for forensic examinations and include dedicated

casework management software providing automatic spectral comparisons and data archiving with search and match facilities.

Foram[®]3 systems can be further enhanced through the addition of a comprehensive library of forensic Raman spectra for the identification of unknowns.

foster + freeman

COMPACT RAMAN SPECTROMETERS DESIGNED TO MEET THE CHALLENGE OF FORENSIC ANALYSIS

Providing rapid, non-destructive, chemical analysis, Raman spectroscopy is a valuable analytical tool with wide ranging applications.

Foster + Freeman Foram[®] 3 instruments offer forensic scientists the full analytical power of Raman, in a choice of laser wavelengths, tailored to meet the specific demands of forensic science with data archiving and casework software and optional spectra databases to aid in the identification of unknown substances.

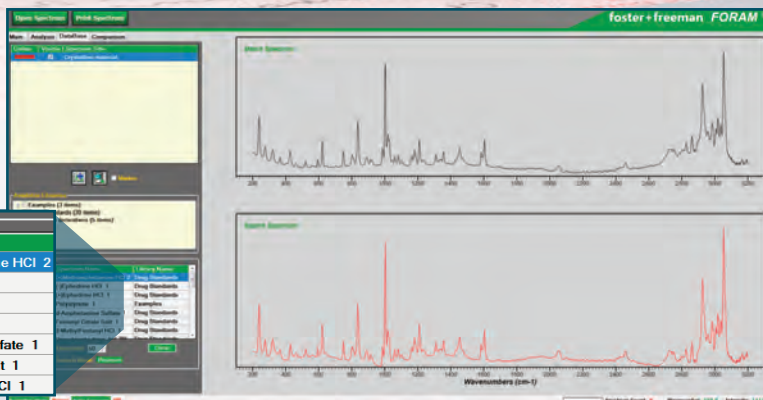
The compact easy-to-use systems can be operated via a laptop, making the Foram[®] 3 a portable system that can be deployed anywhere.

Features include:

- Choice of laser wavelengths
- Raman spectrum in seconds
- Laser spot size of 5 microns diameter
- External cavity laser for improved stability
- Adjustable laser power for sample protection
- A4 size XYZ translation stage
- Integral video microscope for sample selection
- Database facilities for identifying unknowns
- Chemometric comparison routines

Right:
A database search identifies an unknown substance as methamphetamine

% Match	Spectrum Name
99.9	(-)-Methamphetamine HCl 2
84.5	(-)-Ephedrine HCl 1
83.2	(+)-Ephedrine HCl 1
80.4	Polystyrene 1
78.9	d-Amphetamine Sulfate 1
76.7	Fentanyl Citrate Salt 1
76.7	3-MethylFentanyl HCl 1



Choice of Wavelengths

Foram[®]3 is available in a choice of two laser wavelengths. High levels of sensitivity can be achieved with the 685nm laser, while the 785nm infrared laser is better able to suppress fluorescence - particularly when studying organic samples prone to autofluorescence.

Contact Foster+Freeman to discuss the Foram[®] 3 system best suited to your application requirements.

Assisted sample selection

A large, A4 size, XY translation stage with fine spatial adjustment allows the user to align the laser probe on to a sample as small as 5 microns for the selection of individual particles or fibres for instance.

Sample selection is assisted by the use of an integral video microscope that can be fitted with up to four objective lenses to provide magnification of up to x450 on a 24" monitor.

Powerful signal processing

Processing functions such as signal integration and averaging enhance the naturally low intensity of Raman emissions while baseline correction can remove background fluorescence to ensure accurate, reproducible spectra.

Results can be further improved using the SERS technique to increase the Raman signal from a sample by more than one million times.

Spectral Comparison

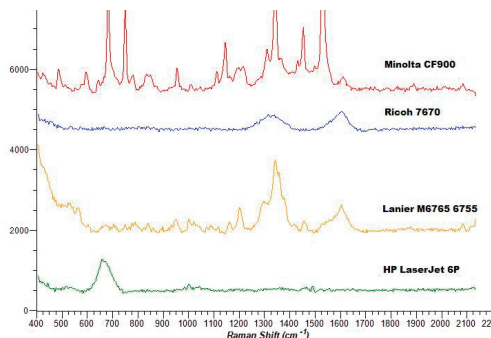
Foram employs an automatic peak-to-peak correlator that identifies the peaks in two pre-selected spectra and determines the significance of their match.

This provides a simple numeric measure of the degree of similarity of two spectra, making it ideal for comparing large numbers of spectra and for database search and match enquiries.

Raman as a Forensic Tool

Raman spectra exhibit numerous features that are specific to molecular structure providing valuable "signatures" for comparing and differentiating materials, making it an ideal technique for the analysis and identification of forensic trace evidence including:

- Explosives, accelerants and gunshot residues (GSR)
- Illicit drugs and their precursors
- Paint chips and smears
- Pen and printer inks
- Fibres and materials



Printer Toners

Questioned Documents

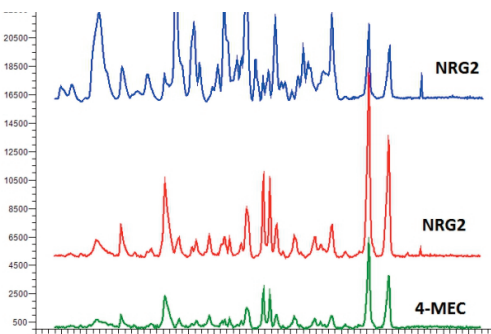
Pen and Printer Inks

Analysing the pigment based ink in Gel Pens presents document examiners with a unique challenge. In-house studies have shown that Raman examination has the ability to differentiate Blue Gel Pen inks with a measure of discrimination in excess of 70%[†].

Printer Toners

While conventional Vis/IR absorption analysis is not applicable to printer toners, Raman analysis of microscopic samples can discriminate toner at a rate of 84%[†].

[†] D. Edwards, "Raman spectroscopy of Printed Documents and Blue Gel Pens" - MSc Thesis, University of Strathclyde, 2008



Legal highs

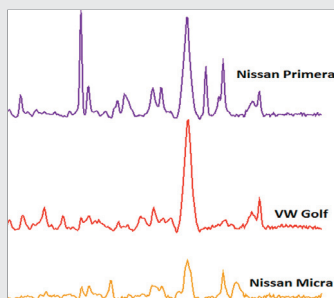
Drugs of abuse

Methamphetamine Precursors

Ephedrine and pseudoephedrine, common precursor materials utilised for the production of methamphetamine, can both be easily identified using Raman in seconds with minimal sample preparation.

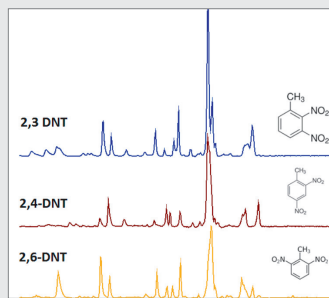
New Psychoactive Substances

Often sold as legal highs, the diversity of these drugs has challenged law enforcement in recent years. They may be encountered as legal or illegal substances, sometimes in mislabelled packaging or with no labelling at all. Raman spectroscopy offers a fast and effective technique for screening the chemical composition of these substances.



Paints

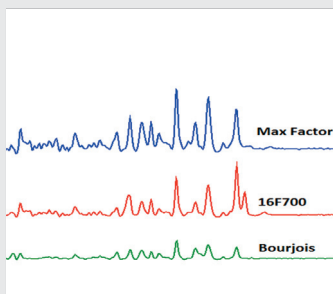
Raman spectroscopy is suitable for the identification of pigments in the majority of paint types. The non-destructive nature of the technique makes it ideal for the examination of valuable paintings and artifacts.



High Explosives

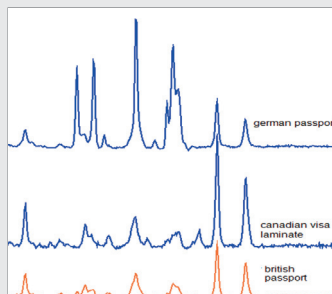
Raman provides a low-cost method of identifying explosives by the "signature" spectrum that the explosive gives.

Positive identifications can be made on particles <5 microns in size.



Cosmetics

Unlike conventional methods of analysis such as thin layer chromatography (TLC) and high performance liquid chromatography (HPLC), Raman spectroscopy can discriminate lipsticks with high level of accuracy.



Passport Laminates

Raman spectroscopy can provide a great deal of information about polymer laminates, including the ability to identify and discriminate polymer compounds, particularly useful when seeking to authenticate passports, ID cards and laminate coated documents.

specifications

Foram®3 685nm Raman Spectrometer

Order Code: FORAM 685-3

LASER PROBE

- External cavity stabilised laser system running at 685 ±5 nm
- Laser power up to 45 mW at source
- Class 3B laser product.

SPECTRAL RESOLUTION

- Spectral resolution 7 wavenumbers

SPECTROMETER RANGE

- Spectrometer range 200 – 3200 wavenumbers.

Foram®3 785nm Raman Spectrometer

Order Code: FORAM 785-3

LASER PROBE

- External cavity stabilised laser system running at 785 ±5 nm
- Laser power up to 80 mW at source
- Class 3B laser product.

SPECTRAL RESOLUTION

- Spectral resolution 6 wavenumbers

SPECTROMETER RANGE

- Spectrometer range 200 – 3200 wavenumbers.

common features

LASER POWER CONTROLS

- Provides operation at 10%, 25% and 100% of maximum power.

DETECTOR

- Thermoelectrically cooled CCD array detector

VIDEO MICROSCOPE

- Microscope turret capable of holding 4 microscope
- Objectives. 20x, 10x and 5x objective fitted as standard
- Colour video camera to align laser spot on sample
- A4 size X-Y-Z manipulation stage with +- 5 mm of X-Y movement at sample centre

SYSTEM DIMENSIONS

- Height Width Depth, 34cm x32cm x 58cm
- Weight, 15kg

COMPUTER

- High specification PC with 24" TFT Wide Screen Monitor
- Full native support for Windows 7 and 8/8.1
- Also compatible with laptop PCs

SOFTWARE

- Software package for spectral analysis, including fluorescence removal filters & comparison casework reports.
- Chemometric routines, such as PCA, PQS, SNV, MSC
- Comprehensive library databasing facility
- Instrument calibration routine and calibration standard
- Software updates for 2 years

SAFETY CLASSIFICATION

Foram3 685 & 785 systems are Class 3B laser products and as such require the appointment of a Laser Safety Officer according to IEC/EN60825:2014

Users are advised to undertake appropriate laser training for high power laser systems, perform a risk assessment for the use of this product and to appoint a laser safety officer.

INVISIBLE
LASER RADIATION
AVOID EXPOSURE TO BEAM
CLASS 3B LASER PRODUCT

Further enhance system capabilities with optional Raman spectra libraries

Identification of samples is made faster and easier through the addition of optional Raman spectra libraries.

Compiled by S.T. Japan, a comprehensive collection of libraries including more than 9,000 spectra of common and specialist materials are available. Libraries provide information on manufacturer, lot number, appearance, purity, IUPAC name etc.

Raman Spectra Libraries currently available:

- | | | |
|--|--|---|
| <ul style="list-style-type: none">• F+F Forensic Raman spectra library• S.T.Japan Forensic Raman spectra library• Polymer and Polymer Additives• Food Additives and Food Packaging• Solvents• Biochemicals• Aldehydes and Ketones• Alcohols and Phenols | <ul style="list-style-type: none">• Esters, Lactones, and Anhydrides• Hydrocarbons• Pesticides• Semiconductor Chemicals• Flavors, Fragrances and Cosmetics• Dyes, Pigments and Stains• Sulfur and Phosphorus | <ul style="list-style-type: none">• Hazardous Chemicals• Hazardous and Toxic Chemicals• Pharmaceuticals, Drugs and Antibiotics• High Production Volume Chemicals• Minerals and Inorganic Materials• Minerals• Inorganic Materials |
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After Sales Support

Foster & Freeman's excellent product engineering is supported with full after sales support including advice, training and maintenance. For more information on our world-wide services please contact your nearest Sales Office.

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