JY Division Information

Raman

Products and Technologies of the Raman Division

Hans-Juergen Reich

Since it's foundation some 200 years ago, Jobin Yvon (JY) has shown a superiour excellence in optical spectroscopy. Part of this group is the JY Raman Division, located in the north of France, in Lille. The close cooperation between leading researchers and pioneers in instrumentation for the field of Raman spectroscopy, i.e. Prof. Delhaye, Dr. Dhamlincourt, and the consequent realisation of innovative ideas into practical systems have created a solid base for the success.

1 Four Decades of Raman History

The technique of Raman spectroscopy has many great advantages and benefits. Besides providing highly specific chemical and molecular information it is a non-contact and non destructive form of analysis.

The Raman scattering process was investigated in the late 1920's so it is not a new technique, but the challenge ever since has been to harness its potential for all manner of applications.

The Jobin Yvon (JY) Raman Division is the world leader in Raman spectroscopy, designing and manufacturing state of the art dispersive spectrometer systems for over four decades.

The very first Raman system manufactured by the company was introduced in the USA in the mid 1960's. Under the SPEX brand name, the famous1400 series were double additive scanning spectrometers with long focal length dimensions. They represented a new step forward in Raman spectroscopy with good high quality optical design, key to their success.

In the mid 1970's the technology saw further evolution with the integration and use of the JY holographic diffraction grating. It also saw the introduction by the company of the first commercial Raman microscope, the MOLE. These innovations laid the foundations for the techniques expansion from research laboratory to a much broader access and its use as a much wider analytical tool.

The JY Raman Division today, comprises of the combined expertise of the JY, DILOR and SPEX brands and is proud of having more than 3500 Raman systems installed worldwide.

2 Philosophy : Cutting Edge and Innovative Design

JY has always prided itself upon its innovative approach to spectroscopy dating back over 150 years. This is very true for the Raman Division, leading the way forward with new spectrometers, laser sources, detectors and sampling arrangements.

Current instruments now exhibit far greater sensitivity, stability and performance than that achieved by the very first Raman systems. Sampling has become easier and automated, with confocal Raman analysis being routinely adopted for all manner of samples from semiconductors, to ceramics, polymers, pharmaceuticals to bio/clinical systems.

3 Instrument Evolution and Applications of Raman Spectroscopy

To continue the success and evolution of the technique, the division has established an application driven range of Raman instruments that spans the full spectrum of requirements demanded by the scientific and industrial customers.

It is the only company to cover all of the different market sectors, with instrument solutions for research, industry, process monitoring, and analytical measurement (Fig. 1). Core to many of the applications has been the exploitation of the Raman microscope. This technology can provide a detailed examination of a sample, analysing a single particle below 1 μm in size.

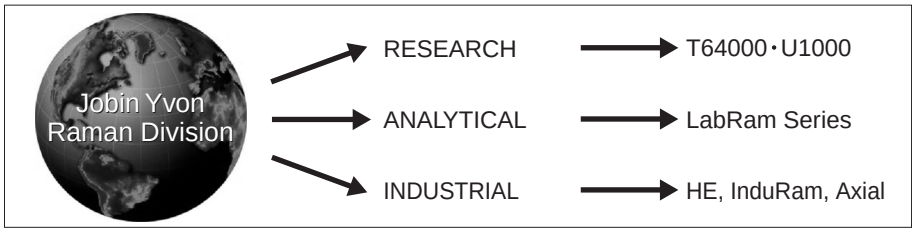

Fig. 1 Instrument Evolution and Applications of Raman Spectroscopy

3.1 Research

The highest performance research systems available, the T64000 and U1000 research instruments figurehead the JY Raman range. These instruments offer the highest level of performance for the high-end research application. They offer the very best Rayleigh rejection and resolution capabilities. The T64000 is one of the only instruments available that can reliably characterise very low frequency Raman bands (down to a few cm^{-1}), which is invaluable for the newest generation of semiconductor, solid state physics and materials research.

3.2 Analytical, Discovery

With the introduction of the integrated LabRam Raman Confocal Microscope family, bench-top, dedicated, high performance Raman systems are available to both the scientific and industrial communities.

This new generation of instrumentation combines the true confocal optical microscope with analytical spectroscopy. It provides the user with a flexible benchtop instrument that has long term stability and most importantly simplified ease of use. It incorporates new and Raman optimised designs which provide data acquisition that is extremely fast and sensitive. It often requires only a few seconds to produce complete spectral information. An important function of the modern Raman microscope has been to provide spatially resolved 'chemical' images. This is a powerful technique for establishing distribution, phase, or stress localisation across a sample surface and one which the LabRam has had core to its development.

The big brother of the range, the LabRam HR, offers superior resolution and functionality unique amongst the bench-top instruments. The system has found applications in stress/strain measurements in semiconductor devices, pharmaceutical polymorphism, UV Raman, NIR micro PL (photo luminescence), in fact any application which demands a more complete characterisation of a samples structure or bonding.

Complementing the conventional microscope sampling the award winning LabRam IR system combines both Raman and FTIR micro analysis upon the single bench-top system. Arguably, for the first time it is possible to obtain the full vibrational spectroscopic characterisation of a

sample from the same sample location. Invaluable for applications such as forensic science, museum/art conservation and catalysis where this unique dual capability provides the very best level of sample identification.

A final and strongly developing area of application for the LabRam has been the biological sciences. The Inverted microscope version for the instrument, the LabRam INV has been adopted as a format which fits the specific requirements of the biological and life science markets. The system can elucidate important information on the cellular level helping to detect early stages of cancer, improve effective drug adsorption, characterise cosmetic formulations and topical treatment regimes.

3.3 Process and Industrial

A recent area of growth outside of the academic and analytical laboratory has been in the field of industrial screening and process monitoring. Requiring specialised equipment, these applications have seen great innovation.

Customised developments of the Raman instrument are applied to industrial QA/QC and screening applications focussing on important global markets, including crystal and wellplate screening for the pharmaceutical market, chemical bulk assays, glass production quality control, and DLC coating analysis. These systems have taken the best technology from the group to provide a fully optimised and dedicated solution for specific applications.

With on-line process control, here too JY has pioneered innovative solutions. The specialised spectrograph designs such as the HE and Axial spectrographs, and the optical fibre probe sampling for remote applications, such as the Superhead, have reached applications previously impractical for Raman spectroscopy. Kinetic reaction monitoring, polymerisations, petrochemical fraction distillations are some of the processes to which Raman has now been applied

4 Conclusion

So, Raman is indeed an exciting technique finding ever newer fields of application. From forensic science to space exploration, each new application has its own challenges and requires its own solutions. The JY Raman Division is proud in participating, even pioneering in this strong growing field of analytical spectroscopy.

Hans-Juergen Reich

Jobin Yvon S.A.S
Raman Division
Manager