RENISHAW

Spectroscopy Innovations

News from the spectroscopy group at Renishaw

June'98

Issue 2

25 years of Renishaw

In 1998, Renishaw celebrates twenty five years of trading, the company having been established by David McMurtry, Chairman and Chief Executive, and John Deer, Deputy Chairman, on 4th April 1973. Today, Renishaw stands at the forefront of automated metrology. The Group's products provide manufacturers with the ability to machine components accurately, and perform measurement traceable to International Standards. Wherever precision manufacturing is required, the use of Renishaw's products ensures that exacting specifications are met, with cost-effective methods.

Renishaw plc is located at Wotton-under-Edge, Gloucestershire and has established subsidiary companies to provide customer support in its major markets of USA, Japan, Germany, France, Italy, Spain, Switzerland, Hong Kong and Brazil, together with Representative Offices in Singapore, The Peoples' Republic of China, Indonesia and India, and a network of distributors worldwide.

For the financial year ending 30th June 1997, sales totalled £M 81.4, of which £M 72.1 represented business overseas. At that date Renishaw employed 801 in the UK, together with 308 overseas, totalling 1109.

From its leading market position, the Renishaw Group continues to expand its product range into ever increasing business sectors, worldwide. Identifying and targeting new market opportunities has led to the continuous development and introduction of new, highly innovative products which significantly enhance the manufacturing capabilities in a wide range of industries.

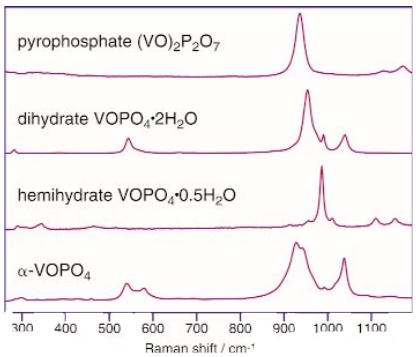
Celebrations of Renishaw's Jubilee will be centred on the official opening of the Group's new facilities at New Mills, Wotton-under-Edge in September, which will be followed by a series of "Open Days" for customers. Details will be published nearer the time.

A "Jubilee" Group Profile is available from the company detailing its history as well as current product applications around the globe. Please contact the Spectroscopy Group, or visit our website **http://www.renishaw.com**, if you would like a copy.

continued on back page...

In situ Raman measurements on catalysts

Raman spectroscopy is increasingly being using in the study of catalysts and catalytic reactions. Professor Graeme Hutching's group at the University of Wales in Cardiff is looking at vanadium phosphorus mixed oxide catalysts (VPOs) used for the selective oxidation of alkanes. Raman spectroscopy is particularly powerful when used in such studies as it can discriminate between the many oxide phases which can exist in the catalysts. In addition, it allows measurements to be done *in situ*, in reactive environments, at high temperature, and because water is relatively weak Raman scatterer, aqueous studies can be undertaken without interference from the water bands.



Raman spectra of various phases of VPO catalyst

continued on page 3...

Ultra-high resolution mapping: a new advance

We are pleased to announce the introduction of a new automated mapping stage for System 1000/2000/3000 Raman microscopes.

The new stage uses another Renishaw product, the RG2 non-contact optical encoder as part of closed-loop feedback systems for the x- and y-axes. This gives unparalleled repeatability and a step size of only 0.1 µm. In other respects the stage performs like the standard 1 µm resolution stage; it is fully integrated within WiRE (Windows-based Raman Environment), Renishaw's proprietary spectroscopy control and analysis software, and can be retrofitted to any Renishaw Raman microscope.

continued on next page...

This edition also contains articles on:

- **dual laser solutions**
- **encoded diffraction grating stage**
- **long standoff fiber optic probes**
- **Renishaw Raman at the Laboratory of the Government Chemist**

NEW PRODUCTS

Ultra-high resolution mapping: a new advance *(continued from front cover)*

High resolution motorized mapping stage.
One of the two Renishaw position encoders is circled.

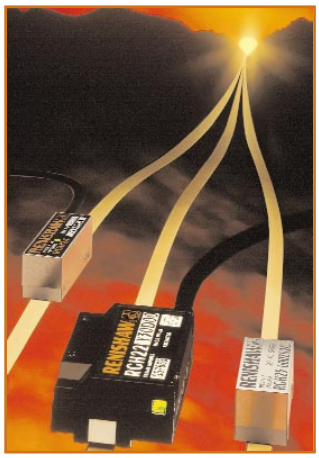
Specifications*

Range of travel:	108 mm x 71 mm, others available
Microscopy:	Leica DMLM or Olympus BHSM
Repeatability:	± 0.5 µm (± 5 µm)
Step size:	0.1 µm(1 µm)
Overall dimension of stage:	306 x 225 x25 mm
Weight of stage:	2.7 kg

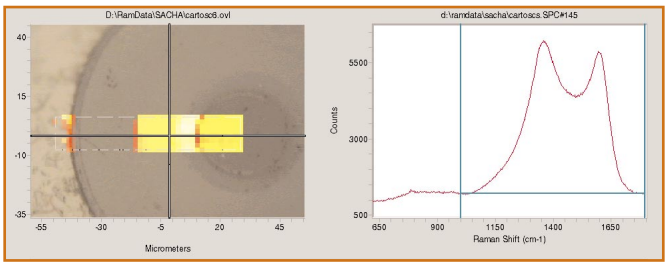
*those for the standard (open-loop) stage are given in brackets

The encoded stage allows users to map finer features on their samples and to reliably return to the same position on the sample, even when the stage has been moved appreciable distances from that point.

A typical application that will benefit from the use of the new stage is the mapping of stress round small features on large wafers of integrated semiconductor circuits.



RG2 encoders

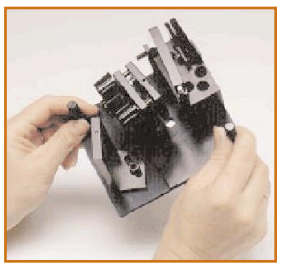


WiRE Raman mapping software display reveals the variation in carbon species in a SiC fiber-reinforced composite material

Data courtesy of A. Vassel and M. Parlier (Office National D'Etudes et de Recherches Aerospatiales) and M. Colomban (Centre National de la Recherche Scientifique), France. For further details of this work, please contact the spectroscopy group and request application note AN/065.

Renishaw dual laser solutions

One of the benefits of the high optical efficiency of the Renishaw Raman Microscope is the corresponding reduction in laser power requirements. Small air-cooled lasers can be used, instead of the large water-cooled lasers that were standard a few years ago. Air-cooled lasers are far less expensive (both to buy, and to run), and spectroscopists can now afford two lasers. For example, many Renishaw customers use a 514 nm argon-ion laser for routine work, and a 782 nm laser diode for studying highly fluorescent samples (such as paints).



Easy Change filter mount

Last year Renishaw introduced Easy Change mounts to facilitate the swap of holographic filters that is necessary when the excitation wavelength is changed. These mounts hold the two holographic filters in the correct geometry even when the mount is removed from the instrument.

Dual Laser Mount with Renishaw 782 nm diode laser (far) and Renishaw 633 nm HeNe laser (near)

We now introduce the Dual Laser Mount. This comprises hardware and optics to mount two lasers on the back of a System 1000/2000/3000 instrument. The optics are designed so that the laser beams are colinear when they exit the mount. When you want to change excitation wavelengths you do not have to adjust any hardware on the mount - just turn one laser off, and the other one on! Together, the laser mounts and the Easy Change filter mounts allow the Renishaw instrument's laser wavelengths to be swapped in a couple of minutes.

The Dual Laser Mounts are available for a range of lasers; please contact your local representative for more details.

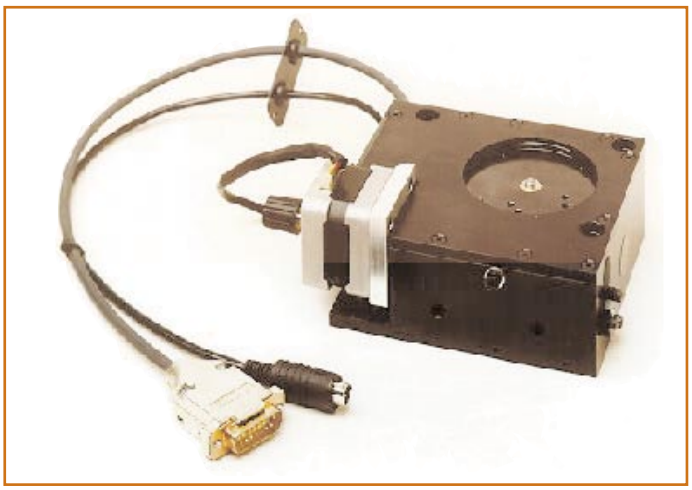
In situ Raman measurements on catalysts

(continued from front cover)

Oxide catalysts are used in a broad range of important industrial processes and are generally prepared in the form of a precursor which is converted into the active catalyst under well defined reaction conditions. VPO catalysts are used to effect the oxidation of n-butane to maleic anhydride. $(VO)_2P_2O_7$ is considered to be the main active component, and is prepared from the precursor $VOHPO_4.0.5H_2O$. Hutching's group is studying the conversion of the precursor to the active form in real time and under the true reaction conditions. Characterisation of the catalyst under a flow of butane in air has been achieved between room temperature and 1000 °C, showing the interconversion between the many phases of the VPO catalyst. The gaseous out flow is then passed into a gas chromatograph to analyse the product mixture. Hence a complete description of the catalytic process including the evolution of the active catalyst is obtained. This system has widespread use for many catalytic systems, and further work will involve the addition of promoters and modifiers to the catalyst and the gas stream to study their effects on the formation of the active catalytic species. Further studies are envisaged using the fiber optic probe system to monitor reactions *in situ* at elevated pressure. This should further enhance the group's ability to study catalyst systems under true reaction conditions.

For further details of this work please contact:
Dr Richard Wells, Chemistry Department
University of Wales at Cardiff.
email: WellsRP@cardiff.ac.uk

Renishaw encoded diffraction grating stage



Renishaw encoded diffraction grating stage

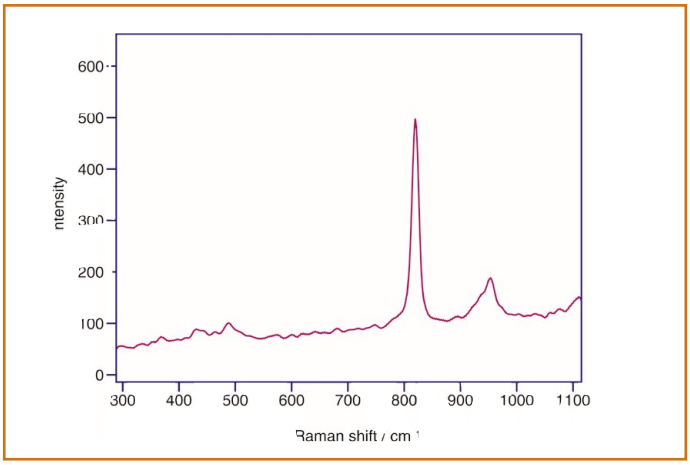
The RG2 optical encoder is also used in the Renishaw encoded rotary stage. This stage is used as a mount for the diffraction grating in many Renishaw spectrometers. It gives a far higher repeatability than previously possible, typically 2 arcsec. This corresponds to a spectral repeatability of ± 0.25 cm^{-1} when a 1800 groove mm^{-1} grating is used on a System 1000 Raman microscope.

The encoded diffraction grating stage is fitted as standard to all new spectrometers, and can be retrofitted to existing Renishaw System 1000/2000/3000 instruments at the customer's site.

Long standoff fiber optic probes

Microscope objectives are ideal lenses for Raman spectroscopy in most respects; they give high magnification images, and their high numerical apertures result in high collection efficiencies. However they normally have working distances (distance from the front of the lens to the sample) of only a few mm. This makes them unsuitable for some applications, such as measurements inside reaction chambers and cells.

The Renishaw spectroscopy group has been developing long working distance optics for the Renishaw fiber optic probes. The spectrum below illustrates the high performance achievable.



Raman spectrum of propan-2-ol, exposure time 2 s

Conditions

Spectrometer	Renishaw System 100
Excitation wavelength	514.5 nm (Ar+)
Power on sample	8.5 mW
Working distance	**0.55 m**
Optical fiber length	10 m
Collection lens aperture	25 mm

Please contact us if such long standoff optics would help you in your applications.

Renishaw Raman at Laboratory of the Government Chemist

LGC
Setting standards in analytical science

Renishaw has recently supplied one of its Raman systems to the Laboratory of the Government Chemist (Teddington, UK) to establish a national (and international) facility for Raman micro-analysis. The system is available to customers requiring an analytical service on either a one off sample/problem-solving basis or on a longer term structured research basis.

For further information please contact either:
Dr. Henryk Herman, LGC, +44 (0)181 943 7316
Dr. Ken Williams, Renishaw plc, +44 (0)1453 844302

25 Years of Renishaw *(continued from front cover)*

1991	Renishaw develops the first prototype of a new generation of compact Raman microscope instrumentation
1992	Raman imaging microscope launched *Renishaw sells 1st Raman imaging microscope*
1993	Class 1 laser-safe version of Raman imaging microscope
1994	782 nm diode laser - the first Raman-ready diode laser
1995	Raman fibre optic probe for remote analysis electrochemical cells for *in situ* Raman measurements
1996	RenCam, Renishaw's CCD camera Renishaw encoded grating stage
1997	UV Raman microscope, DLC analyzer , encoded mapping stage
1998	System 100 - a compact Raman process analyzer, Raman libraries, Renishaw HeNe laser

Key milestones of the Renishaw spectroscopy group

Meet the people

We plan to introduce some of the spectroscopy group to you in each issue, so that you can put faces to the voices you hear on the telephone. To start, here are some of the UK marketing group personnel:

L to R: Anne Bell, Anette Zimmermann, Ian Hayward, Chris Dyer, Jon Woolls, Ian Wilcock, Ken Williams.

This group supports world-wide sales activities and our subsidiaries (see below) and distributors.

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If you or any of your colleagues would like to be added to our mailing list or if you have any queries or comments about the contents of this newsletter, please contact us at any of the addresses above or simply email us at raman@renishaw.co.uk.

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