

Combining the Virsa™ Raman analyser with other analytical tools



Multi-modal analysis

Raman spectroscopy is a powerful analytical technique that can provide a broad range of information on the chemical, crystallographic and structural properties of samples. Combining Raman spectroscopy with other scientific techniques makes it even more powerful and can give you a greater understanding of samples, enabling you to solve complex scientific problems.

Renishaw's Virsa Raman analyser can easily be coupled to other scientific equipment, enabling you to make multi-modal measurements on the same sample, ultimately leading you to a better understanding of the relationship between a material's properties and its chemistry.

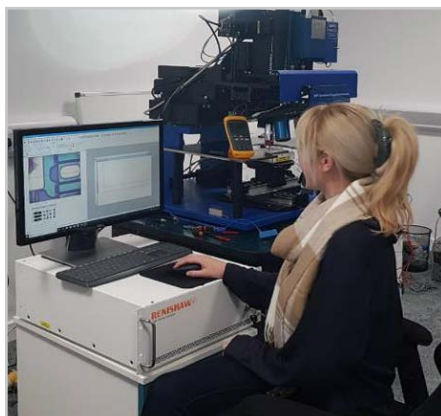


Figure 1 - A Renishaw Virsa Raman analyser coupled to a QFI infrascopes, enabling combined Raman and MWIR thermography measurements.

The Virsa Raman analyser

The Virsa analyser has a number of key features that make it ideal for coupling to a wide range of scientific equipment:

- High spatial resolution probes with research-grade performance for rapid microscopic analysis
- Easily combined with other microscopy techniques to give same point, same time complementary analysis
- Can be placed on a bench or in an industry-standard 19" rack, enabling it to sit side-by-side with existing equipment
- Flexible remote sampling with fibre-optic probes, giving your great flexibility in positioning your equipment
- The Virsa Raman analyser supports a range of probes, giving you a choice of options for sampling volume and working distance
- The Virsa Raman analyser can be connected to multiple probes, allowing different pieces of equipment to be connected to a single Virsa analyser
- Precise probe positioning and sample targeting with the SB100 motorised three-axis probe mount and video unit
- Correlate™ software module enables Raman data to be overlaid and compared to imaging data collected from other instruments
- The Virsa Raman analyser can accept triggers allowing synchronisation and Raman mapping with third party equipment

The rest of this note details an example of how easy it is to couple the Virsa analyser to other equipment.

Raman for thermography measurements

In this example, we demonstrate how the higher spatial resolution of the Virsa analyser enhances an existing technique used for testing semiconductors. When designing and fabricating semiconductor devices, the peak operating device temperature is a valuable parameter which affects both a device's performance and its lifetime. A Renishaw Virsa Raman analyser was coupled to a QFI mid-wave infrared (MWIR) InfraScope, an instrument used to conduct thermography measurements on semiconductor devices (Figures 1 and 2).

This combined system is specifically designed to enable the accurate determination of the temperatures in the layers of a device's structure. It uses MWIR thermography measurements to identify and locate hot spots in the semiconductor devices and then uses Raman spectroscopy to measure the peak temperature in these regions. Alignment and stability are crucial in this application, something that can easily be achieved with the Virsa Raman analyser.

Results

Combined thermography measurements were conducted on a commercial GaN high electron mobility transistor (HEMT). MWIR measurements were conducted on the whole device structure (Figure 3). These were used to locate the region of peak temperature, highlighted in black in Figure 3. Targeted Raman thermography measurements were then made of this region. The device temperature measured with both techniques are shown in Figure 4. Here it can be seen that the MWIR temperatures are about 20% lower than Raman temperatures, despite both giving the same results when looking at a bulk hot source. This discrepancy can be attributed to the higher spatial resolution of the Raman technique giving a more accurate measurement of the small localised hot spot. The Raman measurements are more representative of the peak device temperature and thus more useful for characterising the device and modelling its lifetime.

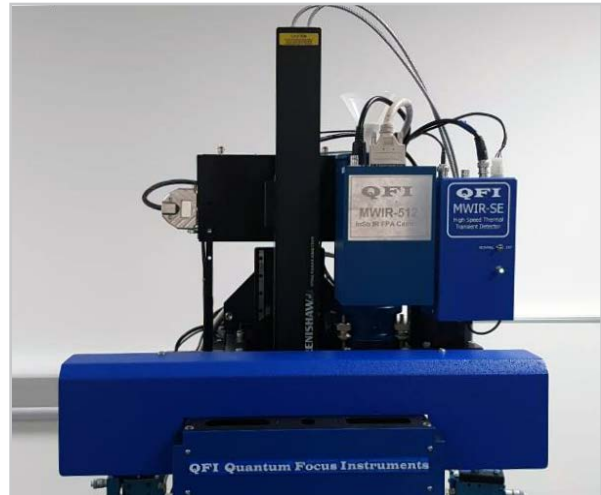


Figure 2 - 532 VRP-20C probe and video unit mounted on the QFI infrascopes.

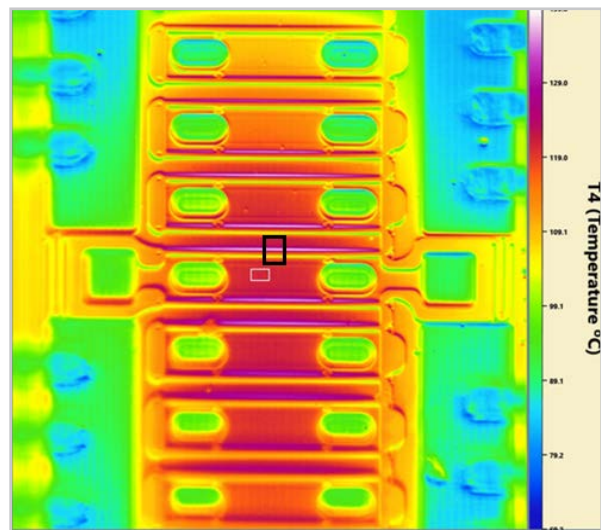


Figure 3 - MWIR image of the temperature distribution in a GaN HEMT device. The area of peak temperature is marked in black.

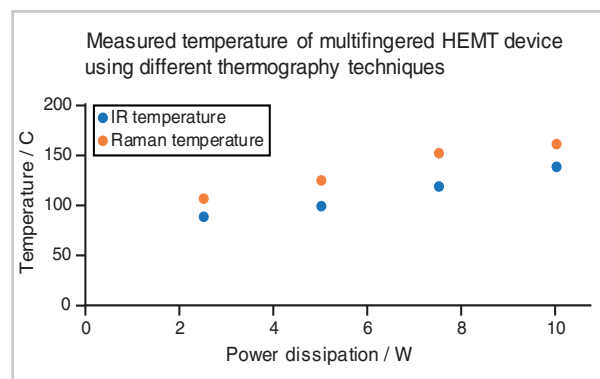


Figure 4 - Comparison between measured MWIR and Raman thermography temperatures for a GaN HEMT device at different operating powers.

Summary

- The Virsa analyser is an extremely flexible tool that can be used to easily add a Raman spectroscopy capability to another instrument
- This MWIR InfraScope example shows the benefit of combining Raman data with IR thermography to increase the spatial resolution of temperature measurements
- Flexible probe options allow measurements under the same conditions, at the same time, on the same point of a sample, ideally complementing other analysis techniques
- The Virsa analyser is compatible with Renishaw's Correlate software module which enables you to overlay Raman images with data from other systems
- Please contact us to discuss adding a Raman spectroscopy capability to your equipment

A range of related Renishaw literature is available. Please ask your local Renishaw representative for more information.

Renishaw. The Raman innovators

Renishaw manufactures a wide range of high performance optical spectroscopy products, including confocal Raman microscopes with high speed chemical imaging technology, dedicated Raman analysers, interfaces for scanning electron and atomic force microscopes, solid state lasers for spectroscopy and state-of-the-art cooled CCD detectors.

Offering the highest levels of performance, sensitivity and reliability across a diverse range of fields and applications, the instruments are designed to meet your needs, so you can tackle even the most challenging analytical problems with confidence.

A worldwide network of subsidiary companies and distributors provides exceptional service and support for its customers.

Please visit www.renishaw.com/virsa for more information.

RENISHAW HAS MADE CONSIDERABLE EFFORTS TO ENSURE THE CONTENT OF THIS DOCUMENT IS CORRECT AT THE DATE OF PUBLICATION BUT MAKES NO WARRANTIES OR REPRESENTATIONS REGARDING THE CONTENT. RENISHAW EXCLUDES LIABILITY, HOWSOEVER ARISING, FOR ANY INACCURACIES IN THIS DOCUMENT.

AN241(EN)-01-A September 2020 © 2020 Renishaw plc. All rights reserved.
Renishaw reserves the right to change specifications without notice.

RENISHAW, the probe symbol used in the RENISHAW logo, and Qontor are registered trade marks of Renishaw plc in the United Kingdom and other countries. **apply innovation** and names and designations of other Renishaw products and technologies are trade marks of Renishaw plc or its subsidiaries.
All other brand names and product names used in this document are trade names, trade marks or registered trade marks of their respective owners.