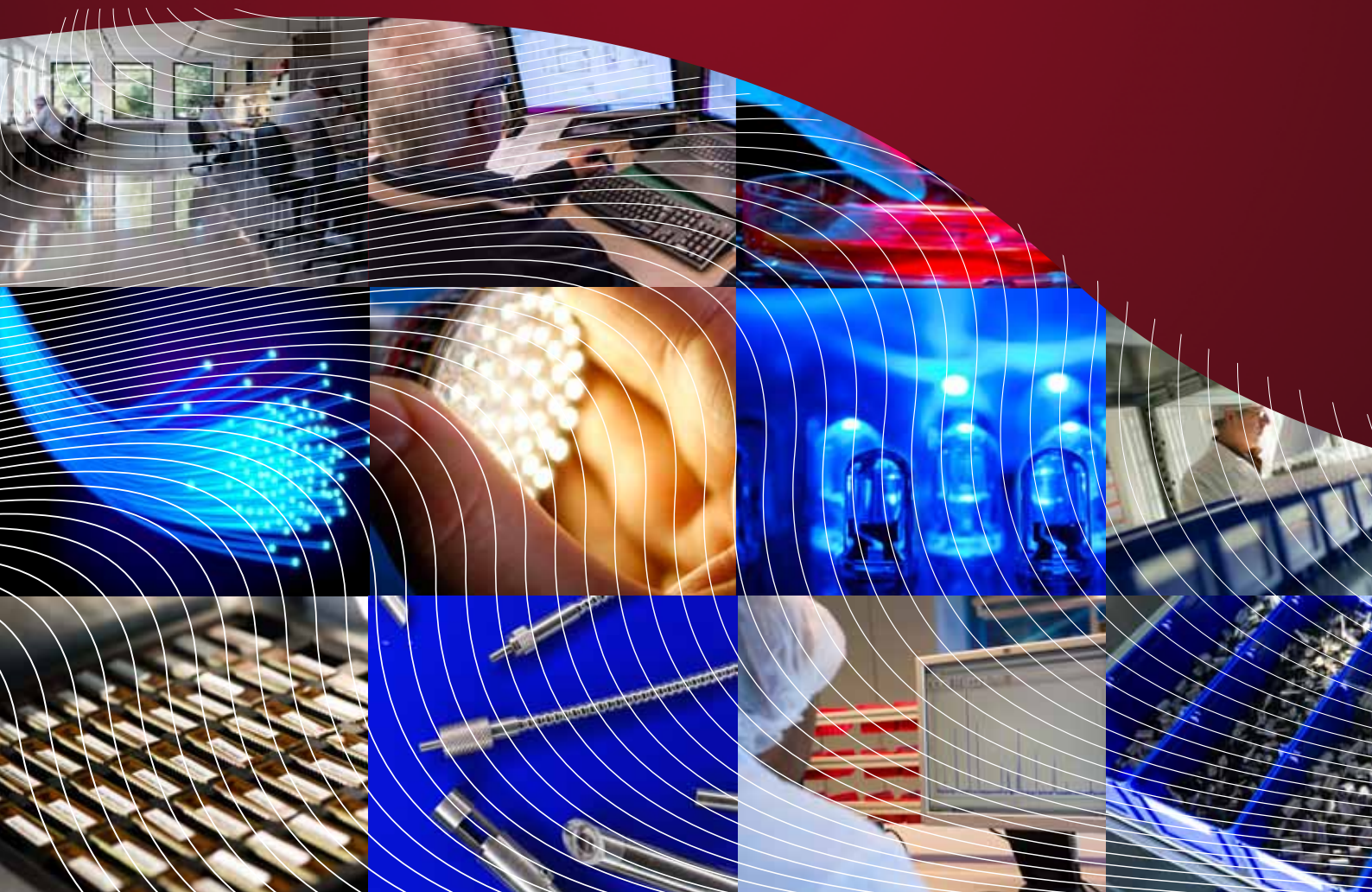


# RAMAN

Measuring Stokes shift

# SOLUTIONS

Easy, fast and reliable



# Solutions in Raman spectroscopy

**Avantes, the leading Raman spectroscopy manufacturer and designer, is the choice for high quality and high repeatability solutions in any spectrometer situation and in any volume.**

**We take special pride in collaborating with our customers to supply the right solution, in time. Whether you need a custom configured optical bench or a specialized fiber optic probe, we have the experience and dedication to make it happen. Or choose one of our modular and flexibly configurable cost-effective Raman options.**



## Industries served

We have almost 20 years of experience applying spectroscopy and optical sensing technologies to numerous environments and industries. Avantes supports Raman and other spectroscopy customers in all aspects, including opto-mechanical, electronics and software, with our dedicated experts.

Examples of industries:

- > Pharmaceutical
- > Gemology
- > Safety & Security
- > Mining & Metallurgy
- > Agriculture
- > Chemical/Petrochemical
- > Bio-medical/Medical
- > Environmental



## Innovative design & technology

Avantes has introduced many industry-firsts in our products, such as on-board processing, replaceable slits and wireless interfaces. A good example is our symmetrical Czerny-Turner design, which allows a higher resolution at similar entrance slits compared to other designs. The latest innovation is our high throughput virtual slit, combining the highest possible throughput with a high resolution. Several of these evolutions and revolutions came from close companionship with an OEM customer.

Avantes' new state-of-the-art manufacturing facilities in Apeldoorn, The Netherlands, is 3,000 square meters or over 32,000 square feet in size. This allows for increased production capacity and has high-tech engineering facilities. Our manufacturing operates according to ISO 9001 standards in our facilities. Avantes' quality procedures provide for 100% traceability of all intermediate and final production test results. These can include additional customer-specific quality control, embedded in the production and QC process. Avantes' world headquarters in The Netherlands is the center of product development, manufacturing and marketing activities.

With additional offices in the USA, China, the UK, and a network of distributors in over 30 countries, we are able to provide outstanding local support. Flexibility in delivery schedules and door-to-door delivery (also to your customer) are standard.

## AvaBench Optical Benches

The AvaBench line of optical benches offers a robust selection of designs and configuration to meet the form factor and technical specifications for each application. Now available in five configurations with 16 standard detector options, the AvaBench is configurable to meet your needs. Independent Optics & Electronics for greater flexibility and modularity. Available as enclosed instruments or OEM modules.

## Raman spectroscopy

Raman spectroscopy is especially useful for product identification, reaction monitoring, remote sensing and any other applicable measurement. It provides an invaluable analytical tool for molecular finger printing as well as monitoring changes in molecular bond structure (e.g. state changes and stresses & strains).

Avantes uses the high-sensitivity AvaSpec spectrometers in combination with a wide variety of lasers (including 532, 633 and 785 nm) to give you the best result for your Raman measurements. The spectrometers are appropriately configured according to the wavelength of the laser.

## Triple stage TEC cooling

AvaRaman-TEC series spectrometers have a three-stage Peltier cooling systems, which provides  $\Delta T$  down to  $-35^{\circ}\text{C}$  cooling to ambient for superior dark noise reduction, keeping the detector at a steady  $5^{\circ}\text{C}$ . Thanks to the PID controller, this temperature is stable within a  $0.1^{\circ}\text{C}$  bandwidth. Every  $5\text{--}7^{\circ}\text{C}$  in temperature reduction means a 50% reduction in dark noise.

A selection of different probes is available to select the right one for your application. Please refer to the back side of this page.

## Probes

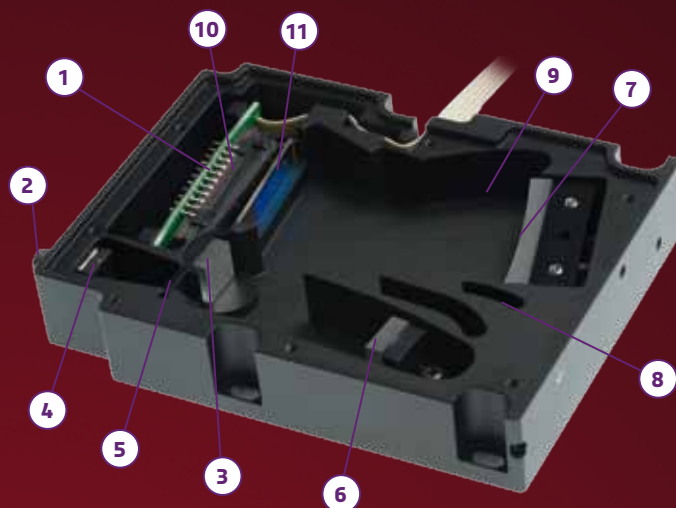
Special Raman probes are available for both fluids and solid substances. They feature different focal lengths, special versions for high temperature and/or high pressure are available. They are optimized for various specific excitation wavelength.

## Laser

Avantes offers ideal lasers for Raman spectroscopy due to their very narrow bandwidth ( $<0.1\text{ nm}$ ): an exact wavelength is critical for the correct excitation of the molecules. Drift fluctuation is very low, under 0.25% over a period of 8 hours, perfect for reaction monitoring. Many different wavelengths are available.

## Supreme High Sensitivity

For the most demanding Raman measurements, Avantes developed the Supreme: providing the highest sensitivity, without compromising on resolution. The integrated high throughput virtual slit (HTVS) enables a sixfold increase in light reaching the detector. Perfect for even the most difficult situations, where high sensitivity in combination with high resolution are key elements.



## Avaspec-ULS Optical Bench Design

- |                        |                    |
|------------------------|--------------------|
| 1. Detector            | 7. Focusing mirror |
| 2. SMA Connector       | 8. CPC light traps |
| 3. Grating             | 9. CPC light traps |
| 4. Slit, mode stripper | 10. DCL-UV/VIS     |
| 5. 2nd mode stripper   | 11. OSC-filter     |
| 6. Collimating mirror  |                    |

## Software

Included with the AvaRaman systems, AvaSoft-Raman enables full control over your Raman spectroscopy system.

In addition to most of the features available in AvaSoft-FULL, AvaSoft-Raman also features:

- Display of the wavelength axis in  $\text{cm}^{-1}$
- Auto calibration routines to determine the excitation laser peak (please note that an AvaRaman-Calibration tile is needed, sold separately)
- Integration time progress bar to indicate integration time status for longer spectral acquisitions
- View signal in normalized counts
- Software baseline correction for fluorescence suppression

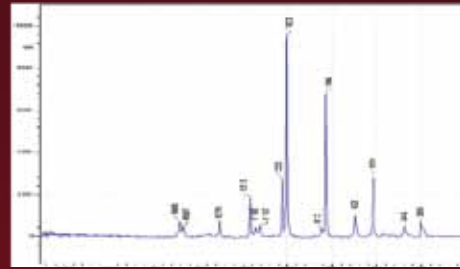
Process control add-on module is available for online analyses and control.

Also available is Panorama<sup>®</sup> software, a sophisticated modular spectroscopy software for demanding end users that require special analytical functions. It enables manipulation of all 2D and 3D spectroscopic data with just a few mouse clicks. It features mathematical noise reduction, functional group assignment and advanced reaction monitoring capabilities.

# A few customer applications...

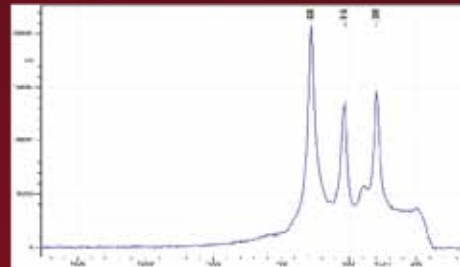
## Polymer Chemistry

- Identification of various polymers (polycarbonate coating layer of cd shown)
- Quality control



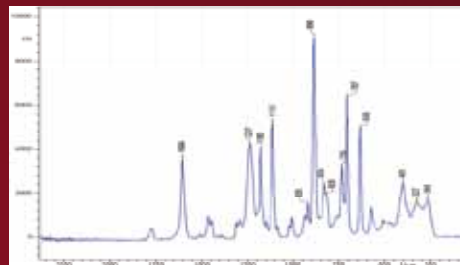
## Inorganic Chemistry

- Identification of inorganic compound such as bariumsulfate, potassiumnitrate, etc.
- Possibility to discriminate between different forms of titaniumdioxide being rutile and anatase (anatase shown)



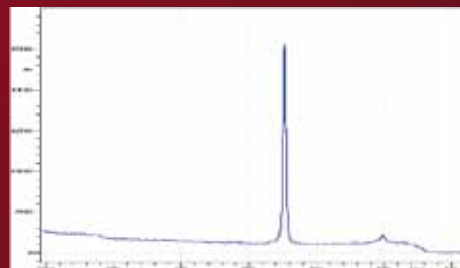
## Organic Chemistry

- Identification of organic compounds such as toluene (shown), acetone, methanol, etc.



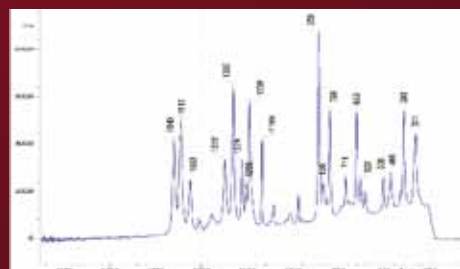
## Semiconductor Industry

- To determine the structure of a wafer (surface damage)



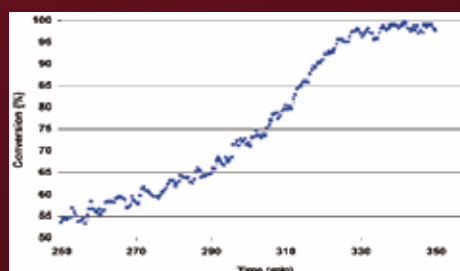
## Pharmaceutical Industry

- Identification of tablets in general (paracetamol shown)
- Identification of counterfeit pharmaceuticals



## Kinetics

- Monitoring the reaction process of polymerizations
- Monitoring the reaction process of liquids



## AvaRaman probes

### AvaRaman-PRB-XXX

3/8" SS low-cost focusing probe with a 200 µm excitation fiber and 400 µm read fiber. Multiple focal lengths available (5 mm, 7.5 mm (standard), 10 mm). It can withstand 80°C. Manual shutter included, 1.5 m fibers. Specify XXX=excitation wavelength



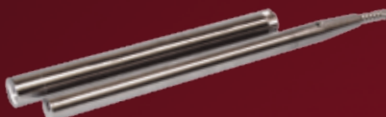
### AvaRaman-PRB-FP-XXX

1/2" SS focusing probe with a 200 µm excitation fiber and 400 µm read fiber. Multiple focal lengths available (5 mm (standard), 7.5 mm, 10 mm). It can withstand 80°C. Specify XXX=excitation wavelength



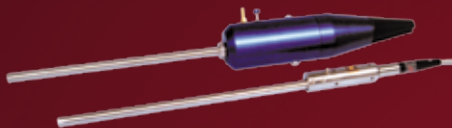
### AvaRaman-PRB-FIP-XXX

5/8" SS immersible focusing probe for in-situ measurements with a 200 µm excitation fiber and 400 µm read fiber. It can withstand 200°C. Specify XXX=excitation wavelength



### AvaRaman-PRB-FC-XXX

3/8" SS immersible process probe for in-situ measurements with a 200 µm excitation fiber and 400 µm read fiber. It can withstand 500°C and 3000psi, the probe optics provide complete background filtering. Specify XXX=excitation wavelength



## Ordering Information

### AvaRaman-532-USB2

Consisting of following elements:

- Solid state 500 mW laser 532 nm, FWHM 0.2 nm
- AvaSpec-ULS2048L-USB2 Spectrometer with 1200 lines/mm grating set 535-752 nm, 50 µm slit, DCL-UV/VIS
- AvaSoft-Raman stand-alone software for the AvaRaman system, AvaRaman-GL-532 laser safety goggles

### AvaRaman-532TEC-USB2

Consisting of following elements:

- Solid state 500 mW laser 532 nm, FWHM 0.2 nm
- TE-cooled AvaSpec-ULS2048L-TEC-USB2 Spectrometer with 1200 lines/mm grating set 535-752 nm, 25 µm slit, DCL-UV/VIS
- AvaSoft-Raman stand-alone software for the AvaRaman system, AvaRaman-GL-532 laser safety goggles

### AvaRaman-785-USB2

Consisting of following elements:

- Solid state 500 mW laser 785 nm, FWHM 0.2 nm
- AvaSpec-ULS2048-USB2 Spectrometer with 830 lines/mm grating set 785-1080 nm, 50 µm slit, DCL-UV/VIS
- AvaSoft-Raman stand-alone software for the AvaRaman system, AvaRaman-GL-785 laser safety goggles

### AvaRaman-785TEC-USB2

Consisting of following elements:

- Solid state 500 mW laser 785 nm, FWHM 0.2 nm
- TE-cooled AvaSpec-ULS2048L-TEC-USB2 Spectrometer with 830 lines/mm grating set 785-1080 nm, 25 µm slit, DCL-UV/VIS-200
- AvaSoft-Raman stand-alone software for the AvaRaman system, AvaRaman-GL-785 laser safety goggles

### AvaRamanXHS-785

AvaRaman Supreme, consisting of following elements:

- Solid state 500 mW laser 785 nm, FWHM 0.2nm
- Spectrometer AvaSpec-XHS with 2048L detector, 1200 lines/mm grating, virtual slit
- AvaSoft-Raman stand-alone software for the AvaRaman system, AvaRaman-GL-785 laser safety goggles

### AvaRamanXHS-785TEC

AvaRaman Supreme, consisting of following elements:

- Solid state 500 mW laser 785 nm, FWHM 0.2 nm
- Spectrometer AvaSpec-XHS with 2048L detector, 1200 lines/mm grating, virtual slit, TE-cooled
- AvaSoft-Raman stand-alone software for the AvaRaman system, AvaRaman-GL-785 laser safety goggles

## Other accessories

### AvaRaman-SH-3/8"

- Rugged sample holder for secure positioning of 3/8" Raman probes

### AvaRaman-SH-1/2"

- Rugged sample holder for secure positioning of 1/2" Raman probes

### AvaRaman-Calibrationtile

- PTFE White tile in holder for 3/8" Raman probe

# Overview Raman systems

## Technical Data

	AvaRaman-532(TEC)	AvaRaman-785(TEC)	AvaRaman-XHS785(TEC) Supreme
<b>Signal to noise Ratio</b>	300:1 for Benzene		
<b>Resolution</b>	$\pm 6 \text{ cm}^{-1}$ *		$< 10 \text{ cm}^{-1}$
<b>Non-cooled Spectrometer</b>	AvaSpec-ULS2048L with grating NC (535-752 nm), slit-50, DCL-UV/VIS	AvaSpec-ULS2048L with grating SI (785-1080 nm), slit-50, DCL-UV/VIS	AvaSpec-XHS with 2048L detector, grating SI (785-1080 nm), virtual slit
<b>Cooled Spectrometer (TEC)</b>	AvaSpec-ULS2048L-TEC with grating NC (535-752 nm), slit-25, DCL-UV/VIS, triple stage TE-cooled	AvaSpec-ULS2048L-TEC with grating SI (785-1080 nm), slit-25, DCL-UV/VIS-200, triple stage TE-cooled	AvaSpec-XHS with 2048L detector, grating SI (785-1080 nm), virtual slit, triple stage TE-cooled
<b>Raman Shift</b>	100-5400 $\text{cm}^{-1}$	100-3600 $\text{cm}^{-1}$	
<b>Laser output</b>	532 nm, 50 mW, Class 3b	785 nm, 500 mW, Class 3b	
<b>Laser Wavelength</b>	532 nm	785 nm	
<b>Laser Bandwidth</b>	$< 0.1 \text{ nm}$	$< 0.2 \text{ nm}$	
<b>Dimensions housing</b>	240 (L) x 140 (W) x 250 (H) mm		300 (L) x 140 (W) x 250 (H) mm

\* typical resolution: higher resolution possible on request



**AVANTES**  
solutions in spectroscopy

For product support or questions, contact us at:

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