

SPECTROSCOPY CONFIGURATIONS FOR FLUORESCENCE APPLICATIONS

SOLUTIONS FOR FLUORESCENCE APPLICATIONS

Fluorescence spectroscopy refers to the measurement of the emission of light by a substance that has absorbed light of a different wavelength. In most cases, the emitted light is at a lower energy state but higher wavelength than the absorbed light. Fluorescence as a spectroscopy application technique is exploding with uses in many industries. It is used to detect counterfeits in the printing industry, protein measurement in life science, mineralogy, pathogen detection, and much more.

Generally, there are two types of fluorescence measurements, endogenous and exogenous. Endogenous fluorescence refers to fluorescence that is naturally occurring in a chemical species, plant, or animal subject. For example, chlorophyll in plants exhibits natural or endogenous fluorescence as does the protein tryptophan in animal tissue. Exogenous fluorescence refers to a fluorescence occurring as a result of the addition of a natural or chemically synthesized fluorophore. For example, fluorescein and indocyanine green are two commonly used fluorophores in medical applications.

Avantes instruments and accessories are frequently used in fluorescence applications. While the traditional go-to instrument for fluorescence is a fluorimeter, a functional solution for fluorescence measurements can be configured with Avantes spectrometers, light sources, and sample accessories. Spectrometer-based fluorescence solutions offer some advantages over traditional fluorimeter instruments including:

- Size/portability enabling integration into handheld devices
- Value these instruments often have a superior price/performance ratio
- Micro-sampling through the use of fiber optic sampling
- Speed Micro spectrometers can support sampling at very high speeds (ms time scales)
- Non-invasive/non-contact sampling

For these reasons and more Avantes instruments are often considered for integration into commercial systems for fluorescence detection to support medical and industrial applications.

The following details some common configurations used in fluorescence applications. It is by no means a complete list of all possible configurations but it provides some ideas. Avantes is not a manufacturer of integrated turnkey solutions, rather a component supplier for fluorescence.

EXAMPLES OF FLUORESCENCE APPLICATIONS



Protein Detection







DNA Sequencing



Identifying radioactive byproduct



Anti-Counterfeiting

FLUORESCENCE CONFIGURATION 1– AVAFLUORIMETER

While Avantes does not offer a true fluorimeter solution, through the combination of a broad-spectrum light source (Pulse xenon or tungsten halogen), a fiber optic monochromator and a broad-spectrum spectrometer, it is possible to create a functional fluorimeter for specific use cases. Available only in North America, the AvaFluorimeter is a configuration that allows end users to individually introduce excitation wavelengths into a sample and simultaneously measure fluorescence. The configuration may include:

OPTION 1: AVAFLUORIMETER SETUP WITH ULS2048CLEVO



Spectrometer

<u>AvaSpec-ULS2048CL-EVO</u> – with replaceable slit technology (200-1100 nm); large slit-200 recommended for higher sensitivity.

Light Source

<u>Avalight-XE-Mini-HP</u> pulsed xenon light source and interface cable to spectrometer

Fiber Optics

<u>FC-UVIR600-1-MS</u> 600 micron core broadband fiber optic cables

Cuvette Holder

CUV-DA- facilitates orthogonal orientation of excitation and emission signals

OPTION 2: AVAFLUORIMETER SETUP WITH AVASPEC-HERO



Spectrometer

<u>AvaSpec-ULS2048X64TEC-EVO "Hero"</u> with replaceable slit technology (200-1100 nm; slit-200 recommended – thermo-electrically cooled to support longer integration times.

Light Source

<u>Avalight-XE-Mini-HP</u> pulsed xenon light source and interface cable to spectrometer

Fiber Optics

<u>FC-UVIR600-1-MS</u> – 600 micron core broadband fiber optic

Cuvette Holder

<u>CUV-DA</u>- facilitates orthogonal orientation of excitation and emission signals



CUSTOMIZATION OPTIONS FOR AVAFLUORIMETER

Beyond the configurations shown above, Avantes AvaSpec instrument lines includes higher performance spectrometers for measurements of lower limits of detection with higher signal to noise performance. The AvaSpec-ULS2048X64-EVO (see figure 1) from our SensLine product family provide for superior performance for more demanding applications.

Fluorescence measurements may also be performed with probe configurations such as the **FCR-**UVIR200/600-2-IND probe (see figure 2). Probes provide greater flexibility for bringing the measurement to the sample. For example many medical applications obviate the need for a probe to sample a smaller area or in vivo measurements on humans. Custom probes can be designed for skin measurements or even biopsy and endoscopy probes that facilitate fluorescence.



Figure 1: AvaSpec-ULS2048X64TEC-EVO

Figure 2: FCR-UVIR200/600-2-IND

FLUORESCENCE CONFIGURATION WITH CUVETTE

For relatively simply cuvette measurements where excitation and emission are oriented at 90 degrees from one another, the following configurations are ideal.

While most fluorescence application do not require a thermo-electrically cooled spectrometer, this type of instrument available in the Avantes SensLine portfolio can be beneficial for use cases where the highest levels of stability and signal to noise is required. Both of these configurations facilitate fluorescence measurements of a signal excitation/emission combination at a time. Selection of excitation wavelength and the starting wavelength for emission light signal is achieved through the use of bandpass (excitation) and long-pass (emission) filtering. Custom cuvette cell holders or inserts are available upon request.

OPTION 1: CUVETTE SETUP WITH ULS2048CL-EVO



Spectrometer

<u>AvaSpec-ULS2048CL-EVO</u> – various range options from 200-1100 nm; large slit (100 or 100 microns)

Light Source

<u>AvaLight-XE</u> & Power supply (PS-12V-2.08A) or <u>AvaLight-LED-HP</u>

Fiber Optics

FC-UVIR600-1-BX or -MS - 1 or 2 units



Accessories

<u>CUV/DA</u>: Direct Attach Cuvette Holder: – optional CUV-Cover-DA recommended

OPTION 2: CUVETTE SETUP WITH AVASPEC-HERO



Spectrometer

<u>AvaSpec-HERO</u>: various range options from 200-1160 nm; large slit (100 or 100 microns)

Light Source

<u>AvaLight-XE</u> & Power supply (PS-12V-2.08A) or <u>AvaLight-LED-HP</u>

Fiber Optics

FC-UVIR600-1-BX or -MS – 1 or 2 units

Accessories

<u>CUV-FL-UV/VIS</u>: Fluorescence cuvette holder

FLUORESCENCE CONFIGURATION - MICROFLUIDICS

Many fluorescence applications involve sampling on small micro-liter volume liquids which present problems for traditional cuvette measurements. Additionally, some fluorescence measurement require a continuous flow monitoring and this obviates the need for a flow cell.

This configuration facilitates fluorescence measurements of a single excitation/emission combination at a time. Selection of excitation wavelength and the starting wavelength for emission light signal is achieved through the use of bandpass (excitation) and long-pass (emission) filtering. Avantes also offers larger industrial flowcells for fluorescence such as the Flowcell-1/4"-FL



INSTRUMENT DETAILS



a) Spectrometer

<u>Avaspec-ULS2048CL-EVO</u> various range options from 200-1100 nm; large slit (100 or 100 microns)

b) Light Source <u>AvaLight-XE</u> & Power supply (PS-12V-2.08A) or <u>AvaLight-LED-HP</u>



c) Fiber Optic

FC-UVIR600-1-BX or -MS – 1 or 2 units



d) Accessories

Flowcell-FL-Ultem – microfluidic flow cell (black Ultem material) with integrated compression seal windows – 1/16'' tubing typical – ONLY AVAILABLE IN NORTH AMERICA

FLUORESCENCE CONFIGURATION WITH PROBE

Probe based fluorescence is one of the advantages intrinsic to a fiber optic-based spectrometers. Probe can be configured in a variety of sizes and shapes to facilitate direct measurement of a sample. Fiber optic probes allow for the measurement to be made in harsh conditions or small spaces while the instrument can be operated remotely. Handheld configurations featuring probes for sample are also a possibility.



Additional Information on Probes

As with the systems mentioned above, this configuration facilitates fluorescence measurements of a single excitation/emission combination at a time. Selection of excitation wavelength and the starting wavelength for emission light signal is achieved through the use of bandpass (excitation) and longpass (emission) filtering. Avantes offers a multitude of standard and custom probes which can be configured for fluorescence applications.

ALTERNATIVE PROBE OPTION



FCR-UV200/600-2-IND

Fluorescence measurements may also be performed with this which may require the use of band pass and long pass filters which allow for the separation of excitation from emission wavelengths. Avantes direct attached (FH-DA) and inline filter holders (FH-Inline), or an LED excitation source.

FLUORESCENCE CONFIGURATION WITH TEMPERATURE CONTROLLED CUVETTE HOLDER

Some fluorescence applications such as life science benefit from temperature stabilization at the sample. This can be facilitated through the use of a temperature controlled cuvette holder such as the CUV-UV/VIS-TC3-FL. This configuration may include a temperature controlled spectrometer or an uncooled instrument.



This configuration facilitates fluorescence measurements of a signal excitation/emission combination at a time. Selection of excitation wavelength and the starting wavelength for emission light signal is achieved through the use of bandpass (excitation) and long-pass (emission) filtering.

INSTRUMENT DETAILS



a) Spectrometer

<u>Avaspec-ULS2048x64-EVO</u> various range options from 200-1100 nm; large slit (100 or 100 microns)



b) Light Source

AvaLight-XE & Power supply (PS-12V-2.08A) or AvaLight-LED-HP



c) Fiber Optic <u>FC-UVIR600-1-MS/BX/ME</u> – 600 micron core broadband fiber optic cables



d) Accessories <u>CUV-UV/VIS-TC3-FL</u>: Temperature Controlled Cuvette Cell Holder



ADDITIONAL ACCESSORY OPTIONS

Beyond the configurations shown in figures shown above, there are two options for additional accessories. The first is the <u>FH-INL</u> – Inline Filter holder for filtering emission light signal (typically long pass filter)., as shown in figure 3 below. The second is the <u>FH-DA</u> – Direct attached filter holder for filtering excitation light signal (typically narrow bandpass filter), as shown in figure 4 below.

The <u>FH-DA</u> is normally attached to the front of an illumination source such as our <u>Avalight-XE</u> or <u>Avalight-HAL-S-Mini</u> to reduce these broadband sources to narrow excitation sources as required by the fluorescence application.

Figure 3: FH-INL

Figure 4: FH-DA





SUPPORT & ADVICE

Providing high-quality equipment is only part of what we do. The other equally important factor is the high level of service we deliver. Our organization includes various specializations to provide you with the best service and advice:

Feasibility studies Our sales engineers perform feasibility studies to find the right solution.

Support team Our support team never sleeps and provides you with the best service.

Demo program Our demo program allows you to try our products for free to ensure you find the perfect solution.

MyAvantes Personal platform where you'll find AvaSoft Software and other material

Online support Helpful documents and tutorial videos for extra help with your products.



ABOUT AVANTES

Avantes is the leading innovator in the development of fiber-optic spectroscopy instruments and systems with nearly 30 years of experience developing customer-defined configurations.

With a long history of consulting with clients across diverse industries and applications, Avantes is an experienced partner, equipped to guide customers who want a solution tailored to their application and research needs. By building worldclass spectrometers and providing second-to-none customer service, Avantes offers customers the peace of mind that the Avantes solutions they purchase will meet, and exceed, their expectations.

Through our headquarters in Apeldoorn, the Netherlands and offices in the USA and China, our sales engineers work closely with our customers to recommend the optimal measurement solution. In addition to our direct offices, Avantes has a worldwide network of distributors in over 35 countries who are ready to assist you. Our production team, which is located at our headquarters in the Netherlands, is dedicated to quality workmanship and has a relentless drive to exceed customer expectations.

Curious how spectroscopy can help you reveal answers by measuring all kind of materials in-line at your production facility, in a lab or in the field? Please contact one of our technical experts, we are happy to help!





CONTACT WE'RE HAPPY TO HELP

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