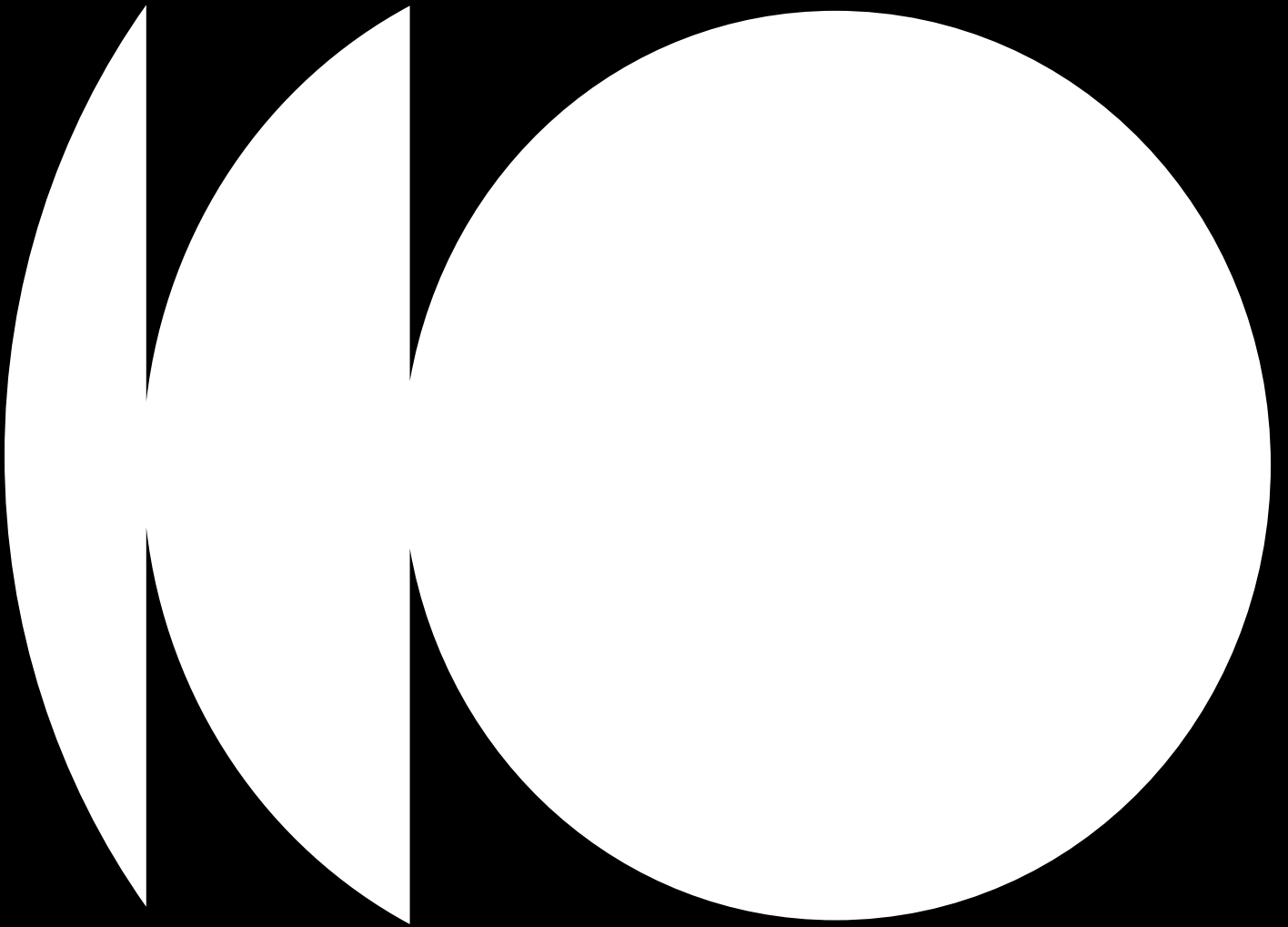


Spectral Solutions for a Safer, Cleaner, Healthier World



oceaninsight.com



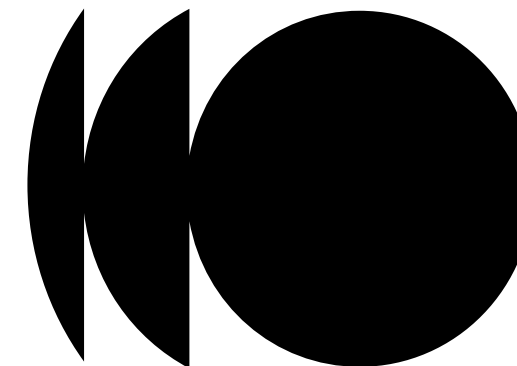
ASK

Ocean Insight is the Applied Spectral Knowledge Company

We use spectral technology, application expertise, and manufacturing scalability to help customers take on important challenges for a safer, cleaner, healthier future.

As Ocean Optics, we were pioneers of miniature spectroscopy, ushering in a new era in optical sensing. Today, as Ocean Insight, we partner with customers in evolving and exciting ways, supporting scientific discovery, waste reduction and sustainability initiatives, and quality of life improvements.

Applied Spectral Knowledge ties our strength in spectral product design and development with in-house, cross-functional, category-specific expertise. By drawing from disciplines including systems and software development; optical, mechanical, and electrical engineering; and industrial design we provide intensive customer collaboration on precise challenges across research institutions and industries of all types.



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IF YOU'RE A ...	WE OFFER ...	FOR THESE AREAS ...
Lab or Field Researcher	Spectrometers Light Sources Optical Fibers Sampling Accessories Software Application Expertise Calibration Services	Education & Academia Government Laser & Photonics
OEM/Product Developer	All of the above, plus ... Spectroscopy Components Multicomponent Subsystems Consultation Mass Customization	Consumer Electronics Energy, Oil & Gas Environmental Food & Agriculture Lighting & Illumination Manufacturing Medical & Life Sciences Pharma Safety & Security
Industrial Customer	All of the above, plus ... Integrated Spectral Systems Algorithm Development Volume Production	

Featured Applications

Here's a summary of the applications covered in this brochure. For more than three decades, Ocean Insight has collaborated with researchers, developers, and industrial customers to tackle challenges across a diverse array of markets and applications.

Industry/Segment	Application	Key Criteria	Product(s)	Technique(s)
Manufacturing	Investigation of methods for safer, cleaner chemical processing	<ul style="list-style-type: none"> • NIR response • Reliability • Small footprint 	Flame-NIR+, NanoQuest and NIRQuest+ NIR spectrometers	Absorbance
Manufacturing	QC of proprietary materials in LED manufacturing	<ul style="list-style-type: none"> • Accuracy • Availability with high-power LED • Flexibility 	LSM-series LEDs, Ocean HDX spectrometer	Fluorescence
Consumer	Characterization of color and other properties in paints	<ul style="list-style-type: none"> • Broadband response • Small footprint 	Ocean HDX-XR extended-range spectrometer	Color, Reflectance
Consumer	Detection of counterfeit consumer goods	<ul style="list-style-type: none"> • Flexible sampling optics • Modularity 	NIRQuest+	Reflectance
Life Sciences	Testing, diagnosis, and treatment of viruses including COVID	<ul style="list-style-type: none"> • Accuracy • Noninvasiveness • Portability • Speed 	Various spectrometers and Raman products	Fluorescence, Raman, SERS
Life Sciences	Monitoring of curing processes for ophthalmic materials	<ul style="list-style-type: none"> • High sensitivity • Real-time analysis • System stability 	QE Pro-Raman+ spectrometer for 785 nm Raman spectroscopy	Raman
Pharma	Development of sensors for detection of fentanyl and designer opioids	<ul style="list-style-type: none"> • Affordability • Simplicity • Speed 	HR4-series spectrometer, HL-2000 tungsten halogen light source	Transmission
Pharma	Investigation of methods for removing the antihypertension drug Valsartan from wastewater	<ul style="list-style-type: none"> • Extended wavelength range • High resolution 	HR4000CG-UV-NIR spectrometer	Optical Emission Spectroscopy
Food & Agriculture	Concentration and emulsion quality of chemical coatings	<ul style="list-style-type: none"> • Batch-to-batch consistency • Real-time, in-line monitoring • System stability 	LTMS liquid transmission measurement system	Transmission
Food & Agriculture	Dissolved oxygen monitoring as indicator of water quality in fish farming	<ul style="list-style-type: none"> • Compatibility with customer's electronics • Flexible form factor • Low cost per sensor 	Disposable oxygen sensor patches	Optical Oxygen Sensing
Environmental	Sun-induced fluorescence and hyperspectral sensing	<ul style="list-style-type: none"> • Accuracy • Flexible configuration • Ruggedness for outdoor use • Speed 	QE Pro spectrometers, Flame spectrometers	Fluorescence, Reflectance
Environmental	Developing new techniques for determining water quality in river systems	<ul style="list-style-type: none"> • Compatibility with fiber optic probe • Measurement reproducibility • Ruggedness 	QE Pro spectrometer	Fluorescence

Testing, Design and Consultation

Ocean Lab Services is our testing and development offering. Tap our experienced team for assistance from feasibility studies and experimental design to more complex support including algorithm development and consultancy.

- Demonstrate proof of concept
- Determine optimum spectral setup
- Ensure confidence in your results
- Save development time and resources



LAB SERVICES

Have an important OEM project to consider? A breakthrough application to test? Start your journey to success with Ocean Lab Services.

oceaninsight.com/labservices



How Can Companies Develop Safer, Greener Chemical Technologies?

CHALLENGE:

As more companies explore ways to avoid harmful chemicals and reduce carbon footprint, they turn to spectroscopy to modify manufacturing processes and evaluate alternative chemistries.

SOLUTION:

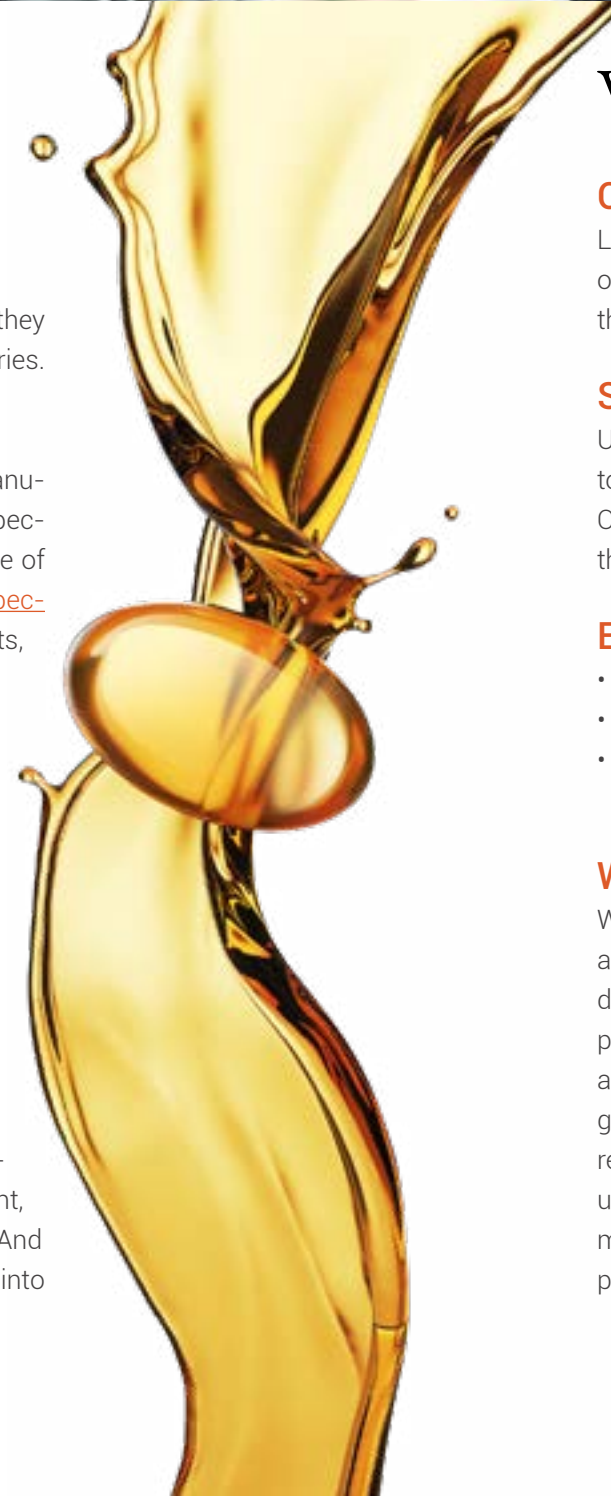
Integrating NIR spectrometers into different stages of chemical processes can help manufacturing plant operators manage processes more efficiently. Each Ocean Insight NIR spectrometer evaluated for a recent application study successfully measured the absorbance of chemicals used in products ranging from adhesive sprays to polyurethane plastics. [NIR spectroscopy](#) is useful for identifying dissolved chemicals in aqueous solutions and solvents, with robust analytical tools helping users to glean actionable insights.

EQUIPMENT USED:

- **NanoQuest** low-cost FTIR sensor (1350-2500 nm)
- **Flame-NIR+** shortwave NIR spectrometer (970-1700 nm)
- **NIRQuest+2.5** high-performance spectrometer (900-2500 nm)
- **HL-2000-HP-FHSA** high-power tungsten halogen source w/built-in attenuator
- **SQ1-ALL** cuvette holder, quartz cuvette and (2) 400 μ m Vis-NIR optical fibers

WHY "GREEN" MATTERS:

According to a 2019 report from the U.N. Environment Assembly, efforts to minimize the harmful effects of chemicals have fallen short of targets, even as the size of the global chemistry industry is expected to double by 2030. Initiatives led by governments and businesses, including investment in process technologies that are cleaner and more efficient, will help to address the environmental tradeoffs associated with chemical production. And for some companies, the cost of regulatory compliance is more than the cost of research into alternative processing methods.



What's the Value of a Modular LED Testing Setup?

CHALLENGE:

LEDs are everywhere, from indicator lights and signage to the display of the device you're reading this on. As developers of innovative LED technologies turn to novel photoluminescent materials to produce brighter, higher-resolution LEDs, they seek simpler, more efficient spectral tools for feasibility analysis in the lab and quality control on the line.

SOLUTION:

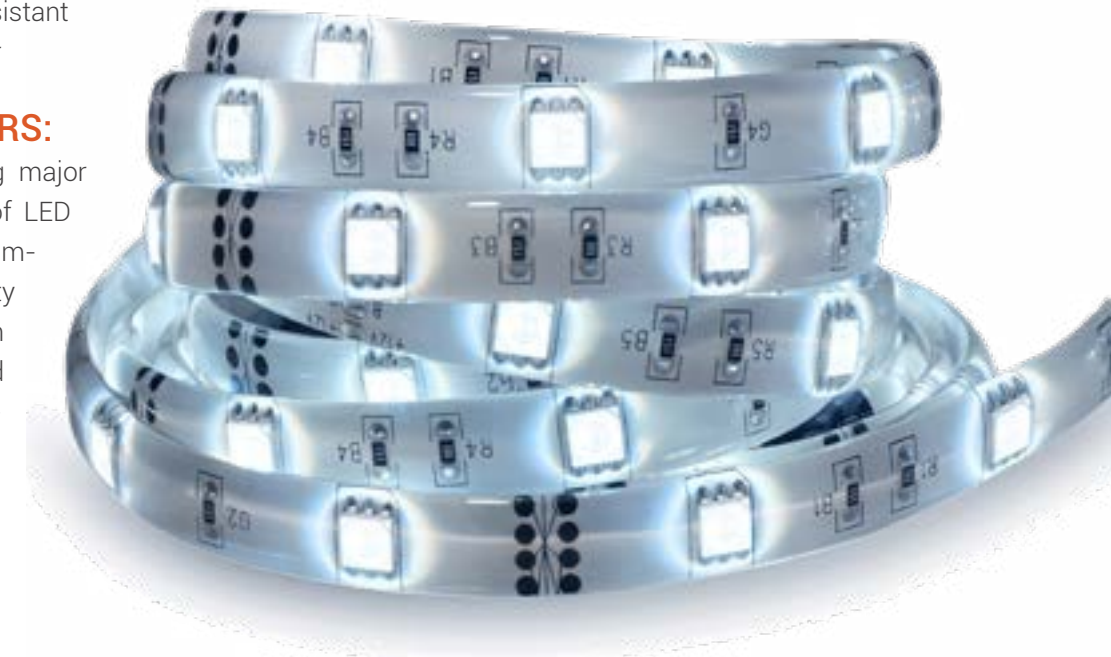
Using Ocean Insight high-power LEDs with a single-channel LED controller, we first stimulated the fluorescence in a customer's nitride LED materials at different wavelengths between 265 nm and 385 nm, then measured the response with an Ocean HDX-UV-Vis spectrometer (200-850 nm). By using LEDs for excitation instead of lasers, the customer will reduce the size, cost and complexity of its QC process.

EQUIPMENT USED:

- **Ocean HDX-UV-VIS** spectrometer (200-850 nm)
- **LSM series LEDs and controller**
- **QR400-7-SR-BX** solarization-resistant reflection probe and probe holder

WHY MODULAR MATTERS:

With global competition inspiring major advances in future generations of LED display technology, even modest improvements in materials quality and process efficiencies can mean greater market share and brand recognition. Modular sensing setups allow users to easily adjust measurements for different sample materials and conditions.





Can Spectroscopy Assess Paint Properties Quickly and Easily?

CHALLENGE:

Paint and coating materials comprise components including pigments, dyes, fillers and binders, with careful mixing of each element contributing to product quality and performance. Being able to evaluate paint formulations and UV-protective coatings within minutes versus hours can make a big difference in development time and cost.

SOLUTION:

For fast, convenient assessment of paint samples on flat surfaces and substrates, we used an extended-range (UV-Visible-NIR) spectrometer with a broadband light source, integrating sphere and diffuse reflectance standard. This modular setup allowed us to quickly characterize both the total reflectance and diffuse reflectance characteristics of each sample.

EQUIPMENT USED:

- **Ocean HDX-XR** extended range spectrometer (200-1100 nm)
- **DH-2000-BAL** deuterium-tungsten halogen source (200-2500 nm)
- **ISP-50-8-R-GT** integrating sphere with gloss trap
- **WS-1-SL** Spectralon® diffuse reflectance standard and holder
- **QP600-1-XSR** 600 µm optical fibers (2)

WHY PAINT QUALITY MATTERS:

There's a lot more to paint than how fast it dries or what a certain color will look like in your living room. For example, paint has additives designed to absorb UV wavelengths, helping to prevent fading and degradation, and even providing disinfection properties. With a spectral system helping paint researchers to test new formulations more efficiently, manufacturers can produce higher quality, longer-lasting and safer paints.



Are These Sneakers Real or Fake?

CHALLENGE:

Counterfeit packaged goods cost businesses and consumers billions of dollars annually, with fraudsters becoming increasingly sophisticated and their knock-offs harder to weed out. Spectroscopy is a technique that can help authenticate products by identifying embedded markers or substandard materials.

SOLUTION:

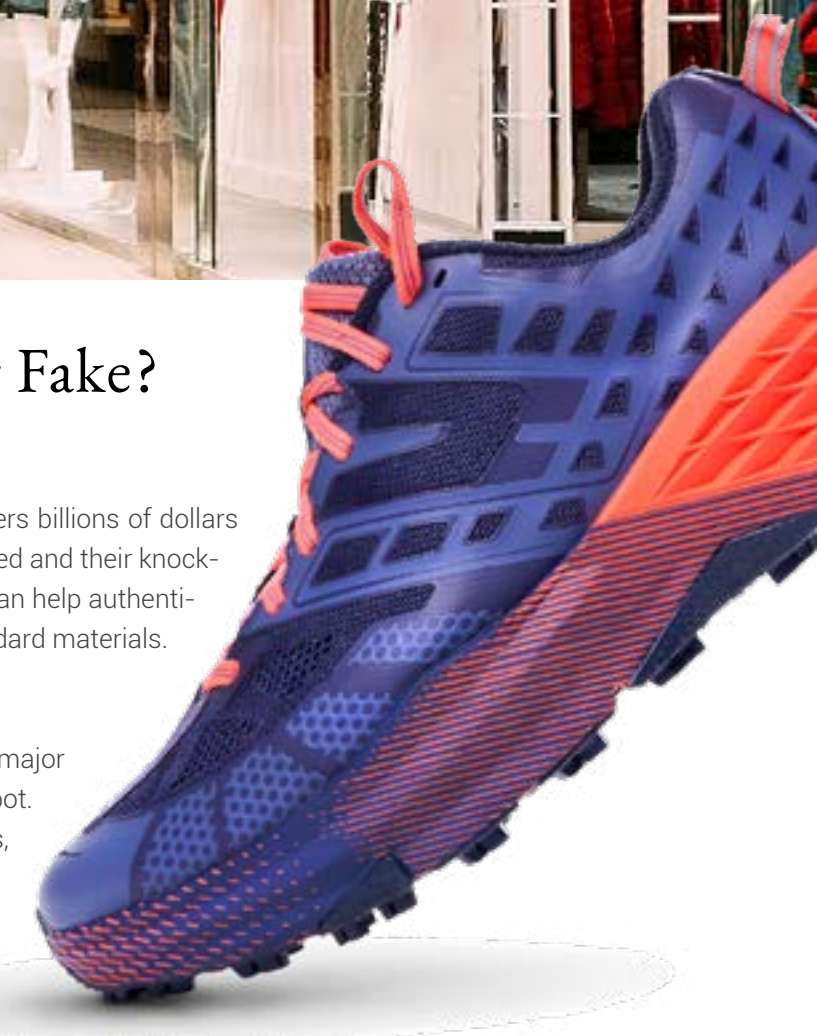
Counterfeiters often use many of the same materials as major footwear manufacturers, making the fakes difficult to spot. To differentiate the branded products from reproductions, manufacturers are using optical authentication techniques such as NIR reflection spectroscopy. In one recent example, we used an NIR spectrometer and spectral data processing techniques to help a product authentication company detect inferior-grade materials in a well-known brand of \$100-plus-per-pair sneakers. Additional investigation could be applied to other shoe types to create comparative performance profiles.

EQUIPMENT USED:

- **NIRQuest+2.5** spectrometer (900-2500 nm)
- **HL-2000-HP** high-power tungsten halogen light source (360-2400 nm)
- **QR400-7-VIS-NIR** reflection probe
- **WS-1** diffuse reflectance standard

WHY ANTI-COUNTERFEITING MATTERS:

Counterfeiting affects everyone, whether it's the dire health consequences of adulterated baby formula or the frightening prospects of forged currency propelling organized crime and terrorist cabals. Fake footwear may not be nearly as consequential, but it still devalues brands and increases prices for consumers. Anti-counterfeiting technologies like spectroscopy can help to protect legitimate businesses and unsuspecting consumers from fraud.





Why Are Curing Rates in Ophthalmic Materials So Important?

CHALLENGE:

With the increasing prevalence of age-related eye disease, the global ophthalmic industry has become a multibillion-dollar marketplace. For manufacturers of lenses used in eye surgery – for example, intraocular lenses (IOLs) for cataracts – simple tools and methods utilizing spectroscopy can speed development of newer, more effective ophthalmic materials.

SOLUTION:

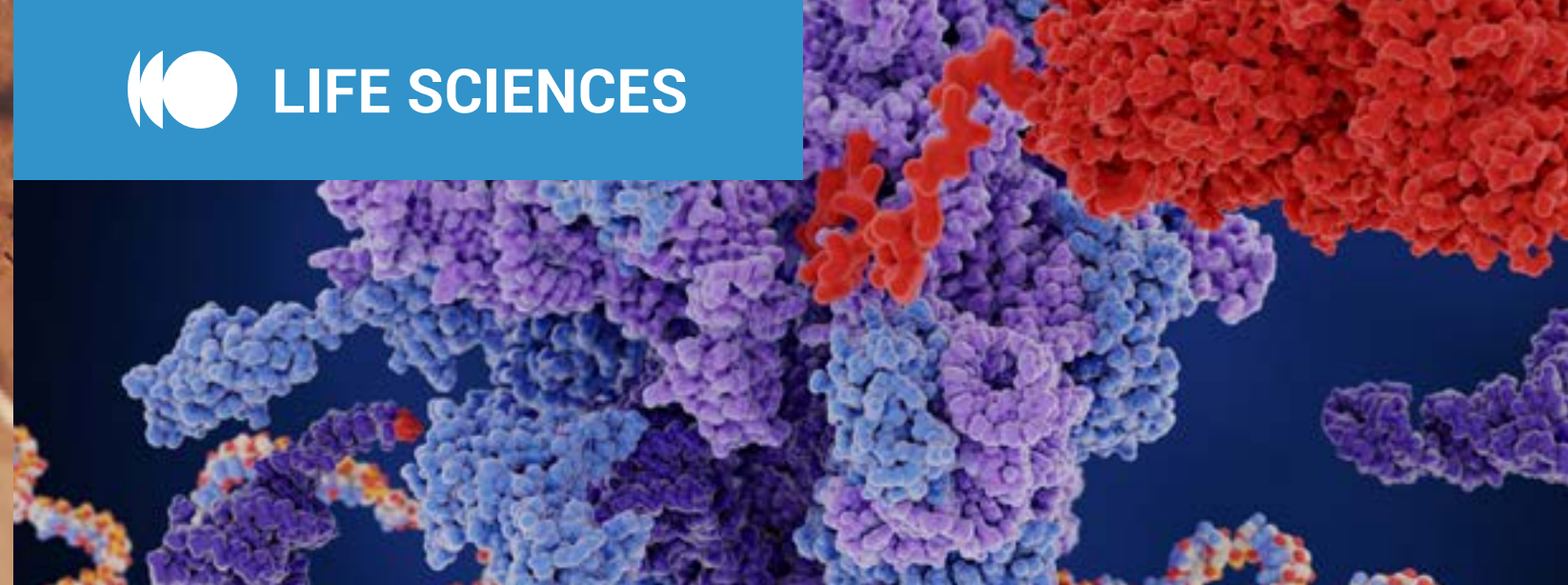
To evaluate the viability of 785 nm Raman spectroscopy to characterize the curing process in ophthalmic materials, we used a modular Raman setup to measure a mixture of chemicals irradiated by a curing lamp. Multiple measurements were conducted over varying levels of exposure time. Based on several clear indicators of polymerization revealed in the data, we proved that [Raman spectroscopy](#) can be effective as a QC tool to characterize the ophthalmic materials before they are used by surgeons in the hospital.

EQUIPMENT USED:

- **QE Pro-Raman+** spectrometer
- **LASER-785-LAB-ADJ-FC** 785 nm Raman excitation laser
- **RIP-RPB-785-FC-SMA** general-purpose Raman probe
- **RM-LQS-SHS** Raman sample holder

WHY CURING TIMES MATTER:

Considering that 10 million cataract surgeries alone are performed annually around the world, any steps taken to ensure successful post-operative results can have a major impact on quality of life. In addition to speeding up lens development time, careful control of curing processes in ophthalmic materials can prevent issues associated with bending and distortion of cured materials, and can help reduce curing lamp use by minimizing the tendency to over-expose materials.



How Can Spectroscopy Help to Control COVID?

CHALLENGE:

Tackling a viral pandemic such as COVID requires a concerted technical effort in understanding, diagnosing, and treating the disease and its effects. In ongoing research studies and commercial projects worldwide, Ocean Insight [optical sensing technologies](#) are helping to improve patient screening and save lives.

SOLUTION:

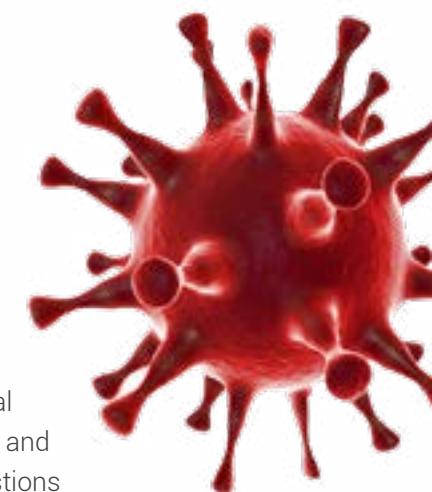
Optical sensing technologies offer speed, portability and less invasive sample collection during testing, and can be integrated into PCR, fluorescence and Raman devices for rapid viral detection. In prevention, spectroscopy is a valuable tool for monitoring the output of UV lamps used to disinfect PPE, hospitals and other spaces.

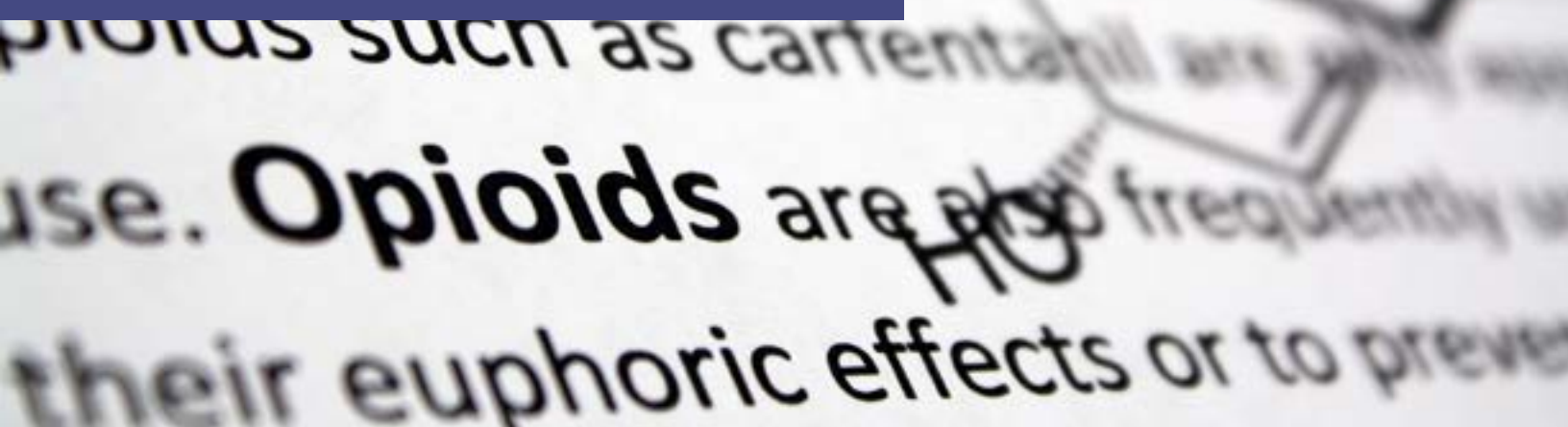
EQUIPMENT USED:

- **Ocean HDX-UV-VIS** spectrometer (200-850 nm)
- **LSM series LEDs and controller**
- **QE Pro-Raman+** spectrometer
- **Surface Enhanced Raman Spectroscopy (SERS)** substrates

WHY OCEAN INSIGHT IS PART OF THE SOLUTION:

Ocean Insight brings a unique level of expertise in spectral hardware, the proper techniques to use with that hardware, and the insight to help customers address the “What if ...?” questions inspired by COVID. Customers involved in advancing viral detection and understanding can rely on our applied spectral knowledge to help unlock the possible.





Can Spectroscopy Help Stem the Flow of Opioids?

CHALLENGE:

The impact of the opioid crisis is staggering. According to the U.S. Department of Health and Human Services, more than 10 million people aged 12 or older abused opioids in 2019, and two-thirds of overdose-related deaths in the U.S. involved an opioid. Now, the emergence of powerful synthetic opioids like fentanyl and its illicit analogs (chemically similar substances) has spurred demand for faster, less expensive detection methods. Could spectroscopy be part of an alternative to current toxicological analysis techniques?

SOLUTION:

A group of photonics and medical technology researchers from several European academic and business concerns has developed a novel [fiber optic sensor](#) for detecting fentanyl analogs in blood. The sensor consists of a long-period fiber grating array with molecularly imprinted markers; an Ocean Insight spectrometer measures the transmission spectrum of the sensor for key analog criteria. Initial results have been successful, demonstrating how the sensor would provide an alternative to existing lab-based instruments that is faster, simpler, more compact and less expensive. What's more, the sensor would be adaptable for different opioids, helping law enforcement and medical professionals more readily keep pace with diagnostic challenges.

EQUIPMENT USED:

- **HR series** high-resolution spectrometer
- **HL-2000** tungsten halogen light source

WHY SCREENING MATTERS:

Although the opioid crisis to date has been largely confined to the U.S., interested parties in Europe and other regions have taken notice. That's partly because current efforts to screen for new designer drugs are so challenging. For example, the U.S. Drug Enforcement Administration has identified nearly 20 different fentanyl analogs, some of which can be up to thousands of times more potent than morphine. Being able to rapidly and cost effectively screen for these illicit drugs will help to save lives and reduce the strain on our already-stretched health care resources.



What Happens to Pharmaceutical Waste?

CHALLENGE:

With growing awareness of the potential for harm from pharmaceutical waste, researchers are investigating new methods to treat waste by degrading compounds that can adversely affect the environment. In one instance, Indian researchers are using spectroscopy to test the efficiency of plasma-based degradation processes in the breakdown of Valsartan, a medication used to treat hypertension and heart failure.

SOLUTION:

Researchers used optical emission spectroscopy to test the [degradation efficiency](#) of different plasma-jet processes on Valsartan solutions, as the emission peaks of each sample's reactive species were readily identified. The Ocean Insight spectrometer collected the response between 200-1100 nm, with an optical fiber sampling setup placed near the plasma treatment area. The flexibility and ease of the setup made testing the treatment processes simpler to manage.

EQUIPMENT USED:

- **HR4000CG-UV-NIR** high-resolution spectrometer (200-1100 nm)
- **QP400-2-SR-BX** solarization-resistant optical fiber with SS BX jacketing
- **74-UV** collimating lenses

WHY PHARMACEUTICAL WASTE MATTERS:

The global market for anti-hypertension medications alone -- including Valsartan -- was estimated at \$25 billion in 2018. Dealing with the potential impact of harmful compounds from other medications making their way into the environment will require cooperation among manufacturers, the health care industry, government agencies and the public. One important element of this effort is access to simple, robust and flexible tools like modular spectrometers to help researchers, regulators and industry engineers quickly assess the efficacy of different pharmaceutical waste treatments.





LTMS Liquid Transmission Measurement System

Real-time, In-line Monitoring

LTMS is a spectroscopy-based system for color and concentration monitoring of liquids in industrial processes such as color anodization and food coatings.

- Analyze color and concentration in plating and dye baths
- Eliminate the need for time-consuming lab analysis
- Relocate easily from tank to tank as needs change
- Get extremely precise batch-to-batch consistency right at the tank

Can Simpler QC Methods Be Applied to Fruitage Coating Processes?

CHALLENGE:

Fruit and vegetable suppliers rely on organic coatings to help preserve and protect the produce as it makes its way to grocery stores and supermarkets. Monitoring these coatings typically requires offline chromatographic techniques, which are very accurate but time-consuming and expensive. With careful integration of components, UV-Visible transmission spectroscopy speeds up QC measurements by providing real-time analysis of coating concentration.

SOLUTION:

In support of a produce industry company, Ocean Insight evaluated several spectrometer setups for transmission measurements of an organic fungicide that delays fruit decay. Extensive testing and analysis in the lab and simulation of factory conditions demonstrated viability for an LTMS-based UV-Visible spectroscopy system, with implementation of certain sample handling and analytical modeling steps to ensure best results.

EQUIPMENT USED:

- **LTMS** Liquid Transmission Measurement System
- **DH-2000-BAL** balanced deuterium-tungsten halogen light source (200-2500 nm)
- **PX-2** pulsed xenon light source (220-750 nm)
- **SQ1-ALL** cuvette holder
- 1 cm pathlength **quartz cuvettes**
- **QP600-025-XSR** 600 μm extreme solarization-resistant optical fibers
- **QP400-VIS-NIR** 400 μm premium-grade optical fibers

WHY COATING QUALITY MATTERS:

As population growth strains our capacity to produce enough food, technology such as edible coatings can help to protect food supplies, extend shelf life, and reduce waste. By integrating monitoring methods into process settings, food producers can more effectively deliver safer, healthier and better quality products.





How Can Fish Farms Maintain Water Quality?

CHALLENGE:

Fish farming is a burgeoning industry that requires careful monitoring of growing conditions to ensure healthy, sustainable production. Techniques including spectroscopy and [optical oxygen sensing](#) are useful analytical tools in aquaculture settings, where access to affordable, real-time measurements contributes significantly to operational success.



SOLUTION:

Ocean Insight has teamed with a leading supplier of technology for fish farming as part of an ongoing effort to elevate the performance of its dissolved oxygen (DO) sensor system for aquatic settings. Optimal DO concentration in water is necessary for the health of fish and is a good indicator of overall water quality. Our oxygen-responsive fluorescent sensor patches integrate into the customer's sensor setup, with lab studies focusing on more robust calibration protocols for deployment in the field, to minimize discrepancies in prior methods and boost confidence in results.

EQUIPMENT USED:

- **NeoFox-GT** optical oxygen system
- **RE-BIFBORO-2** bifurcated fiber assembly
- **RE-FOS-4-KIT** oxygen-sensitive adhesive packages
- **NeoFox-TP** temperature probe
- Custom vessel for environmental test chamber

WHY SUCCESSFUL FISH FARMS MATTER:

Aquaculture is big business. According to the National Oceanic and Atmospheric Administration (NOAA) Fisheries, aquaculture accounts for 50% of all seafood produced globally for human consumption. By accurately monitoring oxygen levels in real time, often in changing conditions, users can analyze that data to improve yield, streamline production, and maintain sustainability.



How Can Spectroscopy Help Preserve Our Planet?

CHALLENGE:

From natural forests and mountain streams to cultivated cropland and man-made lakes, monitoring of environmental elements can give us a comprehensive picture of natural processes and their effects on climate. Ocean Insight has supported field instrument supplier [JB Hyperspectral](#) (Düsseldorf, Germany) with portable, spectroscopy-based systems for measurement of environmental variables including sun-induced fluorescence, water quality and vegetation properties. These systems require spectrometers with the flexibility and durability for demanding environments.

SOLUTION:

JB Hyperspectral (JBH) turned to the Ocean Insight *QE Pro* spectrometer for its signal to noise and optical resolution performance, as well as its ability to communicate with JBH's microcontrollers. With assistance from the Ocean Insight team, JBH has customized instruments for fluorescence and reflection (the latter using our *Flame* spectrometer) that meet challenging performance requirements, consume very little power, and require minimal maintenance. One such system has been deployed successfully in the Alps at an altitude of 2,100 meters, to measure algae on snow, for three years of harsh winters.

EQUIPMENT USED:

- **Flame** spectrometer (400-950 nm; custom options available)
- **QE Pro** spectrometer (650-800 nm; custom options available)

WHY MONITORING MATTERS:

While their motives may differ, researchers, regulators and manufacturers are all invested in better understanding the world around us. Ruggedized, real-time spectral tools that monitor the environment can tell us more about the health of land, sea and air – and their effects on climate – providing insights and guiding our efforts to preserve and protect.





What Can Fluorescence Tell Us About Stream Quality?

CHALLENGE:

Monitoring the water quality of surface waters is important to understanding overall ecosystem health. Of particular interest is the hyporheic zone, the area between stream waters and the aquifer, where subsurface flow patterns can be studied using fluorescent tracers. Hyporheic zone analysis reveals details about the interrelationships of water, sediment and organisms beneath the surface, but can be difficult to manage because of challenging environmental conditions.

SOLUTION:

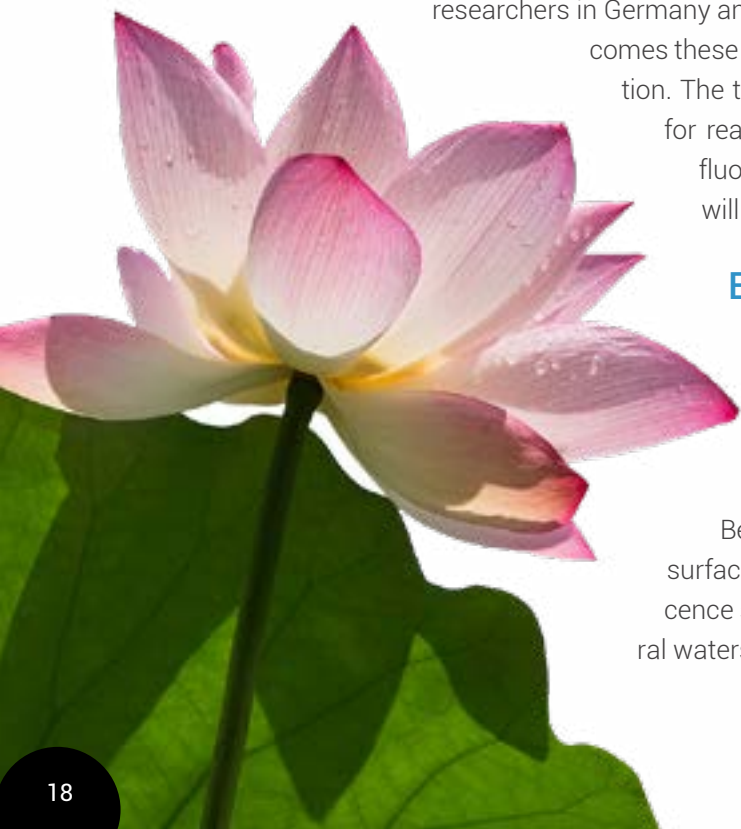
Optical fluorescence sensors are ideal for monitoring sediment pore water (water that occurs in the spaces between sediment particles) in the hyporheic region and for discerning flow patterns, but existing sensor options have mechanical and sampling challenges that affect measurement reproducibility. Now, a group of university researchers in Germany and Australia has developed a robust [fluorescence sensor](#) that overcomes these limitations, with an Ocean Insight spectrometer as part of the solution. The team has conducted successful lab and field testing of its system for real-time measurement of the fluorescent tracer uranine, a form of fluorescein often used in groundwater testing. Additional development will make the system smaller, more flexible and fully automated.

EQUIPMENT USED:

- **QE Pro** spectrometer (350-1100 nm)
- **Bifurcated optical fiber** assembly

WHY BETTER WATER QUALITY SENSORS MATTER:

Beyond its application in monitoring what's going on beneath the surface of streambeds and river systems, the research team's fluorescence sensor system could be adapted for similar analysis of other natural waters, drinking water production and sewage treatment filtration.



Spectral Calibration Services

Confident Measurements, Reliable Results

Ocean Insight offers radiometric, spectrometer wavelength and custom calibration services, as well as helpful accessories for those seeking DIY options.

- Radiometric calibration at our ISO/IEC 17025-certified lab
- Spectrometer wavelength calibration for accurate results
- Custom calibration for spectrometers, oxygen sensors and more
- DIY tools for performing calibrations in your lab



Learn more by browsing the Support tab at [OceanInsight.com](https://www.oceaninsight.com).

Earn up to \$20,000 in Product Grants

Encouraging the
use of spectral
technologies in support
of research that promotes a
safer, cleaner, healthier future.

Grant Applications Open! **Apply Today!**



oceaninsight.com/research-grant