Crystal IS™
High Performance UVC LEDs

WHITEPAPER:

Designing with UVC LEDs:

Accelerating Spectroscopic Applications in Life Sciences and Environmental Monitoring

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Designing with UVC LEDs: Accelerating Spectroscopic Applications in Life Sciences and Environmental Monitoring

I. The High Performance UVC LED Advantage is Here

UVC LEDs are displacing traditional broad spectrum UV lamps in a wide range of spectroscopic applications. Advances in life sciences and environmental monitoring are driving end user demand for flexible instruments to address increasingly complex analytical challenges.

Life science instrumentation relies extensively on molecular spectroscopy for analyses critical for:

> Drug manufacturing

> Protein measurements

> Real-time observation of living cells

Likewise, environmental monitoring uses molecular spectroscopy for:

> Tracking water and wastewater quality

> Ozone monitoring

> Detecting hazardous substances at the point of origin.

Mercury-free, compact, rugged and robust, UVC LEDs offer a suite of solutions to meet these emerging needs in both industries.

Five trends driving overall market growth and innovation in spectroscopic instrumentation include the need for:

> Compact Handheld Instruments

> Cost Effective Instruments

> Increased Productivity

> Real-Time Monitoring

> Higher Quality Optical Measurements

UVC LEDs offer multiple advantages over traditional broad spectrum UV lamps including deuterium, mercury, and xenon flash lamps. These advantages are expanding measurement and monitoring capabilities in the lab and in the field. From wavelength specific and compact design features, to instant on/off capabilities and longer replacement cycles, UVC LEDs provide design engineers and scientists with the flexibility, accuracy and reliability they need across multiple spectroscopic applications.

II. Trends Driving Innovation in Spectroscopic Instrumentation

COMPACT HANDHELD INSTRUMENTS

Miniaturization continues to be a solid trend in the development of mobile spectroscopic instruments. High performance UVC LEDs enable the development of compact, handheld instruments, giving end users the freedom to use instruments where they need them and when they need them. Imagine instruments small enough to fit in a drawer with the power to accelerate workflows associated with water quality measurements, ozone monitoring, or PCR and DNA sequencing.

THE GLOBAL LIFE SCIENCE AND CHEMICAL INSTRUMENTATION MARKET IS ESTIMATED TO INCREASE FROM $30.2 BILLION IN 2011 TO $45.2 BILLION IN 2016. STEADY GROWTH IN DEMAND FOR ANALYTICAL INSTRUMENTATION FOR THE GLOBAL ENVIRONMENTAL SENSOR AND MONITORING MARKET IS EXPECTED TO REACH $15.3 BILLION IN 2016.

THE UVC LED ADVANTAGE

Low voltage—Leveraging simpler power sources for mobile innovations

Low voltage enables the use of simple, safer power sources for several applications, especially for mobile and handheld devices.

Small footprint—Maximize space while increasing instrumentation flexibility

Miniature LEDs and low power requirements replace traditional bulky and fragile lamp construction with compact designs to minimize their laboratory footprint.

Business Case: Ozone Monitoring

Ozone is a major air pollutant considered harmful to public health by the U.S. EPA. Several techniques and technologies exist to measure ozone, but none offers a suitable method for all measurement requirements and locations. Crystal IS UVC LEDs can address these, as well as precision, sensitivity and power requirements, making them ideal for devices ranging from personal ozone monitors to unmanned aerial vehicles for high-resolution, long-term measurements of ground-level ozone.

CUSTOMERS USING UVC LEDS ARE ACHIEVING AS MUCH AS A 50 PERCENT REDUCTION IN SYSTEM COST OVER TRADITIONAL LAMPS.

COST EFFECTIVE INSTRUMENTS

The instant on/off attributes of LEDs reduces laboratory bottlenecks and improves measurement purity, while decreasing overall costs for end users. Unlike the broad, complex spectra of lamps, LEDs have simple spectra—a single peak with narrow spectral bandwidth. The monochromaticity of LEDs is a significant advantage since filtering of unwanted wavelengths is not required. The result is a simpler design with fewer optical elements and lower system cost.

THE UVC LED ADVANTAGE

Monochromaticity—Measure only what you need

Our UVC LEDs have simple spectra. This makes them more selective than existing lamp sources and eliminates the need for additional filters.

Simple drive electronics—Lower your overall system costs

Complex power supply requirements and ancillary electronics in conventional UV lamps pass on additional costs and increased operational complexity to the end user. UVC LEDs optimize performance and lower overall system costs by allowing design of instruments with as few, or as many, features required for end user applications.

INCREASED PRODUCTIVITY

Sharing or borrowing instruments to take a quick measurement is a thing of the past. High performance UVC LEDs give end users the capability to measure more samples in less time and accelerate the pace of complex molecular spectroscopic analyses.

THE UVC LED ADVANTAGE

Instant on-off cycles—No more waiting

Our UVC LEDs enable instantaneous output modulation which benefits sensor applications ranging from life sciences research to water quality monitoring.

Low cost of ownership—Monitor more locations

End users can employ a network of sensors to monitor multiple locations from a central control room rather than task several technicians to collect grab samples throughout the plant or across a community.

REAL-TIME MONITORING

High performance UVC LEDs are effective for remote, unmanned monitoring, and enable trace detection of pollutants at the parts per billion (ppb) level to comply with state and federal air and water regulations. Their stable light output makes Crystal IS UVC LEDs ideal for accurate measurements at wastewater treatment plants, industrial facilities, and in marine and freshwater ecosystems. UVC LEDs also provide an environmentally-friendly alternative to using mercury lamps.

COLLECTION OF CONTINUOUS, REAL-TIME DATA AT THE PPB LEVEL ALLOWS CUSTOMERS TO DECREASE RESPONSE TIME TO POTENTIAL PROBLEMS FROM DAYS TO HOURS, AND SAVE THOUSANDS OF DOLLARS IN OPERATIONAL AND MAINTENANCE COSTS.

Business Case: Oil in Water

UVC LEDs are rugged. Able to withstand great temperature and pressure changes, they are ideal for use in maritime experiments and monitoring water distribution systems. Our LEDs are an effective solution in oil spill science and response. In deep-UV sensing settings, Crystal IS LEDs have demonstrated an increase of 5.5 times in signal strength over a leading competitor, enabling measurement of lower levels of hydrocarbons.

THE UVC LED ADVANTAGE

Longer replacement cycles—Decrease maintenance costs

We lead the industry in lifetime with more than 1,000 hours. End users gain the added benefit of lower overall maintenance costs and greater reliability for remote monitoring.

Small footprint—Compatible with industrial equipment

Sensors using UVC LEDs fit into existing equipment and monitor processes without adding bulky instruments or requiring significant redesign of large industrial equipment.

Stability of light output—Decreased noise increases accuracy

Crystal IS UVC LEDs produce a lower baseline noise than competitors. Achieving this produces more accurate and precise measurements of small peaks important in sensitive materials characterization.

OUR BREAKTHROUGHS IN LOW-DEFECT DENSITY, SINGLE CRYSTAL ALUMINUM NITRIDE SUBSTRATES, COUPLED WITH PROPRIETARY-TECHNOLOGY IN CRYSTAL GROWTH AND LED FABRICATION, PRODUCE THE BRIGHTEST UVC LEDS AVAILABLE—IN THE DEEP UV SPECTRUM.

HIGHER QUALITY OPTICAL MEASUREMENT

UVC LEDs are notably stable light sources, unencumbered by the mechanisms which lead to fluctuations in other traditional UVC light sources. Their high spectral quality provides measurement linearity over a wide concentration range, making them ideal for absorption and fluorescence spectroscopy applications in analytical and life sciences instrumentation.

Business Case: Absorption & UV Fluorescence

In UV fluorescence spectroscopy for trace detection in the environmental, industrial and biotechnology industries, secondary peaks can overlap with the fluorescent signal and lead to reduced signal-to-noise ratios, especially when fluorescence quantum yields are small. Reducing the intensity of the secondary peak is critical. Crystal IS LEDs have much lower secondary peak when compared to other commercial UVC LEDs. This enables measurements of small concentrations of impurities in pharmaceutical development and low concentrations of ozone or oil contaminants in water.

THE UVC LED ADVANTAGE

Stable Light Output—Improve measurements

Stability of light output is critical to ensuring consistent and repeatable excitation for quantitative imaging. Our UVC LEDs allow for consistency of results over longer measurements.

High spectral quality—Increasing accuracy

The full width half max (FWHM) of the Crystal IS LED spectrum is sufficiently small, allowing for all of the diode's intensity to be focused into a very narrow wavelength providing high spectral resolution, and a more accurate measurement due to a higher signal-to-noise ratio.

Instant on-off capability—Better overall measurements

Instant on-off capability allows end users to take multiple measurements over a quick amount of time and average the results to generate an overall higher quality final measurement.

III. A Few More Advantages...

In addition to providing design engineers with superior technical capabilities and design flexibility, UVC LEDs also offer additional work space, environmental and sample integrity benefits.

INCREASED LAB SPACE

Simple electronics and smaller product design reduces instrumentation space requirements. At one-quarter the size of existing traditional broad spectrum UV lamps, our UVC LEDs make it easier for users to integrate new instruments into existing lab space.

ENVIRONMENTALLY FRIENDLY

Easier disposal, longer light source replacement cycles, and lower energy consumption support company's sustainability goals. LEDs are also mercury-free—a key advantage for customers concerned with water and air quality monitoring.

NO FRONT SIDE HEAT

Lower voltage UVC LEDs are ideal for heat-sensitive biological samples for bio-pharmaceutical drug development or genomic research. Unlike traditional broad spectrum lamps, UVC LEDs radiate minimal amount of heat from the front side. Instead, most of the heat generated in the chip is extracted out of the back side through conduction so as not to interfere with measurement.

Advances in UVC LED performance, reliability and robustness are accelerating what's possible in spectroscopic applications for life sciences and environmental monitoring. Provide your end users with the product flexibility and freedom that comes from designing with high performance UVC LEDs. From at-sea experiments and unmanned aerial measurements to oil spill response and real-time observation of cells, UVC LEDs are expanding spectroscopic measurement and monitoring capabilities to meet tomorrow's demand today.

We invite you to learn more about our UVC LEDs.

Crystal IS™
High Performance UVC LEDs

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