Heraeus

High-quality light sources for analytical instruments

Repeatable precision for consistent and sensitive analysis

Portfolio

Applications	Portfolio
Atomic absorption spectroscopy	E F
Atomic fluorescence spectroscopy	F
Emergency first response	D
Exhaust monitoring	C D E
Fluorescence spectroscopy	B
Gas chromatography (GC)	D
High Performance Capillary Electrophoresis (HPCE)	B E
High Pressure Liquid Chromatography (HPLC + UHPLC)	E
Instrument calibration	H
Leak detection	C D
Mass spectrometry (MS)	D
Mercury analysers	H
Personnel safety in confined spaces	D
Pollution monitors	A B C D E
Process control	A E
Semiconductor inspection	E
Thin layer chromatography (TLC)	E
UV-Vis spectroscopy	A B E G H

The first broadband UV LED – for mobile environmental monitoring

Environmental monitoring has never been easy: FiberLight® L_3 is perfectly designed for mobile and handheld analytical devices such as in UV-spectroscopy. The first broadband UV LED module saves you time and money: Analyze samples right in the field – no need for shipping to the laboratory.

page 5

Measuring and analyzing seawater

Water analysis is becoming increasingly important, not only for marine research and the fishing industry, but also for controlling dangerous chemicals in water. FiberLight® D_2 enables highly sensitive water analysis particularly in the deep blue sea just above the ocean floor quickly and safely – with the greatest accuracy.

page 6

Controlling special material of sun glasses

While xenon lamps are suitable for many white light industrial applications, the FiberLight® Xe is expressly intended for photometric instrumentation applications. Due to its high-energy pulsed light, it's especially suited for analyzing optically dense materials. FiberLight® Xe is used e.g. to control and inspect the special material of sun glasses.

page 8

Monitoring environmental pollution

NOx is produced from the reaction of nitrogen and oxygen gases in the air during combustion. Especially in areas of high motor vehicle traffic and high temperatures, the amount of nitrogen oxides emitted into the atmosphere as air pollution can be significant. Serious health issues and ozone formation can be the consequences. This NOx Module plug & play light solution makes environmental pollution monitoring more accurate and much easier.

page 10

Detecting explosives at the airport

Photoionization detector (PID) lamps by Heraeus help ensure safety at airports: They allow easy and reliable passenger screening in airports worldwide. Due to its reliability and consistency, our PID lamps are used in explosives trace detectors (ETD) at major airports around the world.

page 12

Ensuring fair sports competitions

Testing the best: Deuterium lamps enable extremely low detection limits and high sensitivity to determine illegal doping by athletes – and thus ensure the fairest sports in competition.

page 14

Keeping your drinking water clean

Hollow Cathode Lamps (HCL) by Heraeus help you prevent drinking water with too high concentrations of iron, cadmium or zinc. They facilitate analytical methods like Atomic Absorption Spectrometry (AAS) for the quantitative and qualitative analysis of many elements such as metals or semimetals in mostly liquid solutions and solids.

page 16

Pure pharmaceuticals

Tungsten Halogen lamps are typically used in visible spectrophotometers in the analytical and medical markets to measure concentration levels, impurities, and chemical kinetics.

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FiberLight® product family
For mobile monitoring applications.

The Heraeus FiberLight® product family offers specialty light sources ideal for applications with limited space in the equipment, whether stationary, portable, handheld or even battery-driven instruments.

Low power consumption, small dimensions and ease of operation open up new possibilities for instrument designers. With the fiber coupling all light sources are easy to integrate. Various light sources and systems for individual applications are available.

FiberLight® L_3

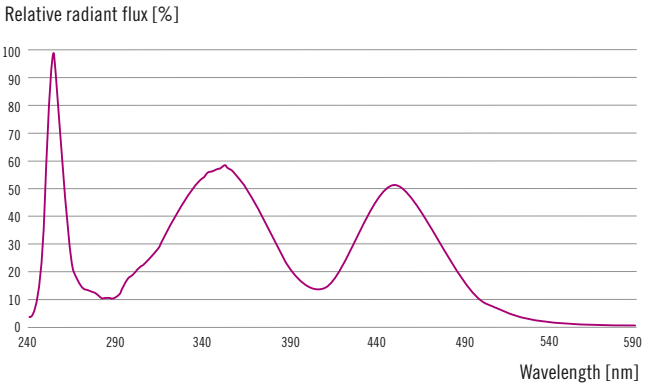
A new species of light:
The first broadband UV LED for mobile spectroscopy.

Environmental field based analysis has never been easy. Current on-site measurement methods are restricted by the mobility and limited battery life of the measurement device. Typically, a sample is taken in the field and then shipped to the laboratory for analysis. A very time consuming and logistically complex method.

FiberLight® L_3 is a new light source solution which offers the advantages of state-of-the-art LED technology combined with a true broadband spectrum. With its low power consumption and compact size, the module is easy to integrate into battery operated mobile and handheld devices. The plug & play feature ensures an easy integration and mobile usage. Furthermore FiberLight® L_3 reduces costs and time per measurement. This UV LED solution also offers a broadband UV spectrum using a unique technology based on a single LED. This opens completely new application fields and gives unexpected flexibility in analytical measurement methods like mobile UV spectroscopy and also flash chromatography.

The result: a new species of light – and an entirely new world of possibilities for your mobile analytical measurement.

Spectrum of FiberLight® L_3



Features and Benefits

- Broadband UV spectrum (250 – 490 nm) enables the detection of a wider range of substances
- The long lifetime (> 5.000 h) means reduced maintenance and lower costs
- New application fields are possible due to unqiue combination of features like low power consumption (< 1.5 W) and the small size (60 × 63 × 48 mm)
- Fiber coupling and plug & play set up for easy integration

FiberLight® L_3

10 mm

FiberLight® D_2

UV-Vis light source for high measurement consistency.

Measuring and analyzing seawater – With FiberLight® D_2 mobile measurements can be made with the greatest accuracy.

Monitoring seawater helps ensure compliance with environmental regulations and protects sea life from dangerous chemicals. Water analysis is also increasingly important for marine research and the fishing industry. FiberLight® D_2 is especially suitable for testing the quality of seawater in the deep sea just above the ocean floor quickly and safely.

FiberLight® D_2 enables highly sensitive water analysis directly on site.

FiberLight® D_2 Basic

The 6W FiberLight® D_2 Basic is the only UV-Vis light source on the market combining a deuterium lamp, with a tungsten lamp, a shutter, optical system and an SMA 905 connector in such a compact module. The spectral emission covers the entire range from 200 nm to 1100 nm and can be extended to 185 nm. All components are mounted on a printed circuit board. Both lamps and the shutter can be individually controlled by a TTL signal.

The small size of the FiberLight® D_2 makes it the ideal light source for applications with limited space in the equipment, whether stationary, portable / handheld or even battery-driven instruments. Low power consumption, small dimensions and ease of operation open up new possibilities for instrument designers. With the flexibility of the product and design Heraeus can meet the customers' needs.

Features and Benefits

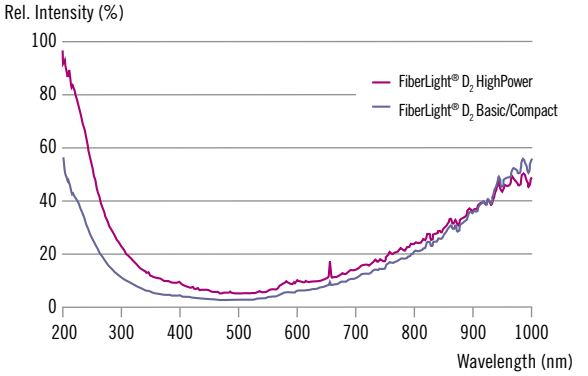
- Reduced design costs due to a plug & play light source module
- Easy integration and optical coupling using an SMA connector
- Space saving size which allows integration into small devices
- Instant ON/OFF enables cyclic operation which can extend the lifetime up to 3 years

FiberLight® D_2 Compact
The FiberLight® D_2 Compact Module is an UV-Vis light source covering the whole spectral range from vacuum UV to near Infrared with an even smaller size. It includes all the advantages of the Basic module, but offers an even more compact unit for applications demanding the smallest package possible.

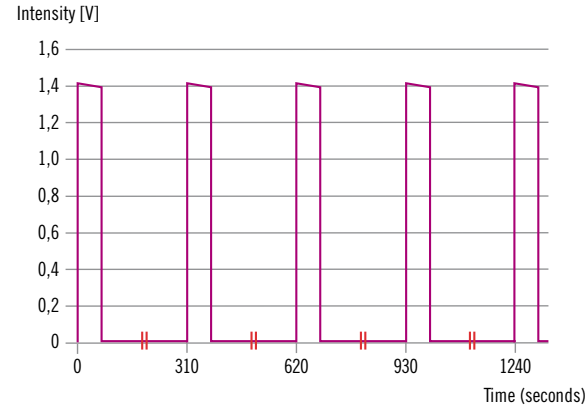
FiberLight® D_2 HighPower
A 12 W FiberLight® D_2 HighPower version is available, offering double UV light output and similar compact size. Higher power means faster response and lower detection limits; while still small size suitable for portable operation.

Instant ON and Instant Stability
The FiberLight® D_2 electrodeless discharge lamp (EDL) is the only deuterium lamp that can be switched instantly ON and instantly deliver a stable light output. FiberLight® D_2 is therefore the ideal light source in analytical instruments for waste water analysis and other pollution monitoring where light absorption is measured for only a few seconds and repeated after long intervals. As an EDL, the number of ignitions does not reduce lifetime. In addition, cyclic lamp operation results in an extended service life of up to three years.

Spectral Comparison FiberLight® D_2



Cyclic Operation



FiberLight® D_2 Basic

FiberLight® D_2 Compact

FiberLight® D_2 HighPower

FiberLight® Xe

Plug & play solution for photometric instrumentation applications.

While xenon lamps are suitable for many white light industrial applications, the high quality, high performance range of FiberLight® Xe is expressly intended for photometric instrumentation applications such as: UV-Vis spectroscopy, fluorescence spectroscopy, liquid chromatography and also thin film measurement, flash chromatography or semiconductor inspection. Due to its high-energy pulsed light, it is especially suited for analyzing optically dense materials. It is used e.g. to control and inspect the special material of sun glasses.

FiberLight® Xe efficiently converts electrical energy into high intensity light flashes. The compact stand-alone units that can be operated on 12 V or 24 V input and up to a lamp power consumption of 5 W.

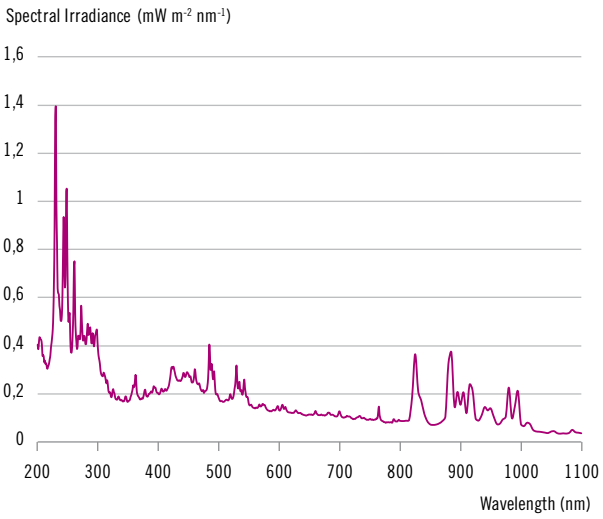
The modules include a xenon flash lamp, power supply and connections fully enclosed in a metal housing. Heraeus FiberLight® Xe provides a broad continuous UV-Vis spectrum with very good flash-to-flash stability due to carefully selected electrode materials and design. In addition to long service life, this makes them the ideal light source for UV-Vis and fluorescence spectroscopy, as well as online process monitoring or thin film measurement.

Heraeus offers a wide variety of FiberLight® Xe with different beam options.

There are side-on and end-on emitting systems available, each with an option of either vertical or horizontal electrodes.

The electrode orientation is measured along the longitudinal axis of the module. This way you can choose a lamp module to exactly match the optical requirements of your system. In addition to these standard options, Heraeus manufactures xenon flash lamp modules with an SMA connector. These modules have a pre-aligned SMA905 fibre connector that efficiently couples the module´s light into the optical fibre. This makes integration into analytical equipment even simpler and faster.

Spectrum of FiberLight® Xe



Features and Benefits

- Broad spectral range (185–2000 nm) for single light source instrument design reduces costs
- Low noise and high stability light output (< 2 % CV) for analytical perfection
- Plug & Play: compact unit with 9-pin D-sub connector for faster instrument design
- Long lifetime (> 10^9 flashes) reduces maintenance costs
- SMA fibre connector versions available for simple and fast integration

FiberLight® Xe family

NOx Module

Plug & play light solution for monitoring environmental pollution.

NOx is produced from the reaction of nitrogen and oxygen gases in the air during combustion. Especially in areas of high motor vehicle traffic and high temperatures, the amount of nitrogen oxides emitted into the atmosphere as air pollution can be significant. Serious health issues and ozone formation can be the consequences. The NOx Module plug & play light solution makes environmental pollution monitoring more accurate and much easier.

NOx is a generic term for the nitrogen oxides NO and NO_2. It reacts in our atmosphere to form a wide variety of toxic products, as well as supporting the formation of ground-level (tropospheric) ozone. Common methods for measuring NOx include sensor technologies based on chemiluminescence and electrochemical techniques.

This requires conversion of NO_2 to NO for measurement or calculation of the NO_2 content based on an assumed NO : NO_2 ratio. In addition, NOx can be measured with IR but that can be affected by the H_2O and CO_2 content in the sample. Direct UV absorption measurement of both NO and NO_2 is the more precise way to measure total NOx for continuous emissions monitoring, and measurement in the UV-region avoids the influence of H_2O and CO_2.

However, system development based on UV Resonance Absorption Spectroscopy (UV-RAS) has been difficult in the past due to challenges in tuning the UV-lamp operation within its environment to optimize lifetime and intensity.

NOx Module

The Heraeus NOx Module integrates an EDL and corresponding power supply inside a metal housing. A NOx EDL is a lamp with N_2, O_2 gas fill that emits a spectrum in the wavelength range from 200 nm to 800 nm. Spectral lines in the 200 nm region can be used for the detection of NO and NO_2, H_2S, NH_3, SO_2 and others. Heraeus Noblelight has developed a plug & play light solution for NOx Measurement. The NOx Module offers a pre-tuned UV-light source in a stable environment with easy plug & play integration into OEM UV-RAS systems.

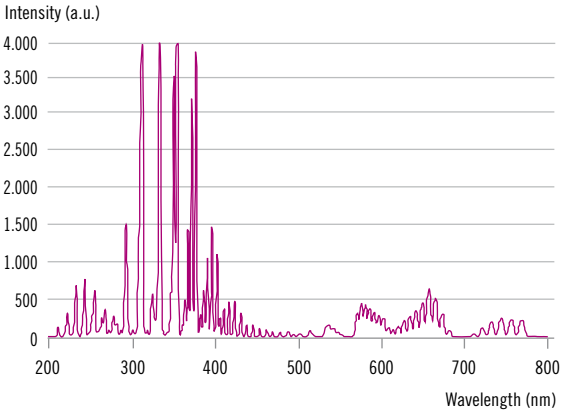
Features and Benefits

Plug & Play 12 V
- Simple integration
- Reduced design-in costs
- Easy to replace

NOx specific lines
- Accurate measurement
- High sensitivity

Long lifetime
- 1 year plus for continuous monitoring
- Low cost of ownership
- Long replacement intervals

Spectrum NOx Module



10 mm

NOx Module NO1

Photoionisation Detector Lamps

For high quality gas detection and gas chromatography.

Detecting explosives at the airport
Photoionization detector (PID) lamps from Heraeus detect explosives at major airports around the world, thus ensuring safe travel of passengers and crew. Major airports around the world choose our PID lamps for their explosives trace detection (ETD) needs due to its simplicity, reliability and consistency.

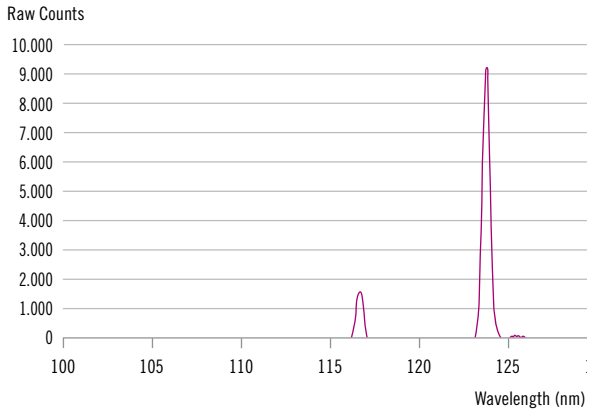
VOC detection or air quality monitoring
PID lamps from Heraeus help keep the public safe from harmful pollutants in the air by helping industry and governments monitor air quality and meet increasingly stringent regulations. Laboratories, petrochemical plants, factories, cities, and major airports rely on Heraeus PID lamps to rapidly and reliably detect and monitor a range of harmful gases.

Heraeus manufactures PID lamps using the world's first and only fully automated process. This enables quality and consistency levels that would not be possible otherwise. As a result, OEM manufacturers of analytical instrumentation such as gas chromatography (GC), mass spectrometry (MS), volatile organic compound (VOC) detectors, and explosives trace detectors (ETD), rely on Heraeus PID lamps to maximize their instrument performance while reducing the end-users cost of ownership.

Available in either DC or RF, Heraeus offers a complete range of PID lamps with the highest quality in terms of intensity, spectral purity and long life. Additionally, the PID lamps are available with different gas fills and window materials. Our fully automated RF Lamp production enables us to offer the shortest delivery times in the industry without sacrificing quality.

Heraeus works alongside OEMs to design and build products that meet their specific dimensional and instrument performance requirements.

Spectrum Krypton PID Lamp



Features and Benefits

- Enhanced lamp life through accurate control of bulb dimensions and gas fill pressure
- Shortest delivery times in the industry due to ease of production scalability
- Customized lamp designs and dimensions to fit your specific application
- Different gas fills and window materials with photon energies from 8.4 – 11.8 eV for more selectivity in gas detection
- High purity window material for better transmission and higher intensity
- Proprietary getter technology and high purity gas fill for longer lamp life

Did you know? Heraeus Noblelight is the first PID manufacturer to use an automated production process which ensures more reliable processes for the highest quality lamps. Clear advantages for the customer: consistent quality, longer operating lifetimes and quickest delivery times.

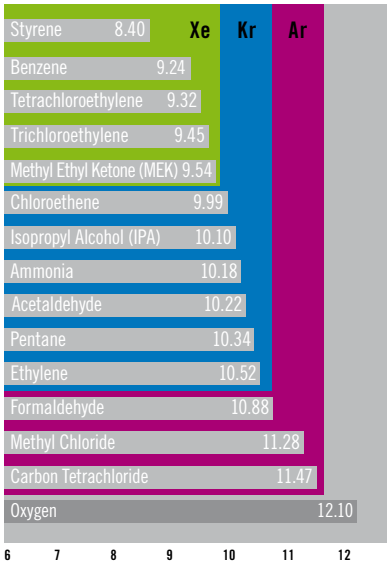
PID, RF excited
AUTO
6 mm diameter

PID, RF excited
12 mm diameter

PID, DC excited
20 mm diameter

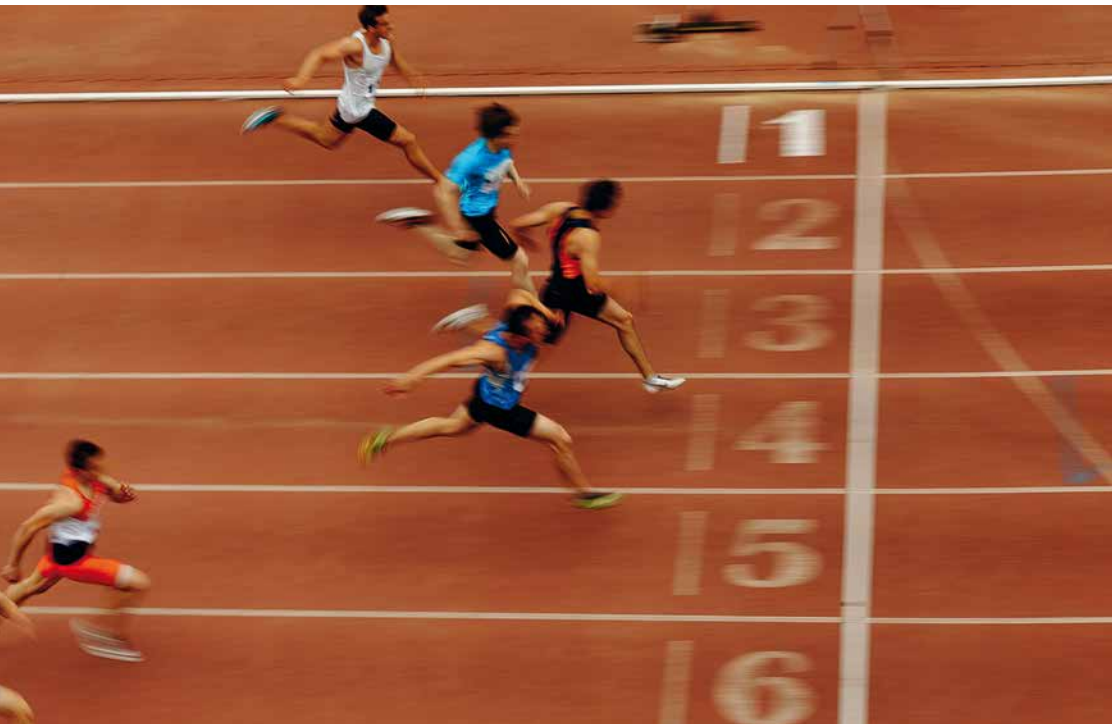
PID, DC excited
35 mm diameter

Detectable Substances with PID



Deuterium Lamps

Extremely low detection limits and high sensitivity for HPLC and UV-Vis analysis.



To ensure fair sports competitions athletes must submit urine samples to test for illegal doping. Similarly, analyzing pharmaceuticals for their purity, content, and quality ensures effectiveness and safety for patients.

In these situations various analysis methods are appropriate, such as UV-Vis spectroscopy for purity testing or high-performance liquid chromatography (HPLC) for determining the content of the active ingredients.

Heraeus specialty light sources are ideal for both analysis methods. High-quality deuterium light sources provide reliable and very precise measurement results to ensure accurate test results and product quality.

Using the latest material and process technologies, Heraeus' new lamps combine unmatched output stability and intensity over a lifetime of more than 2,000 hours. This clearly places them above from other long-life lamps on the market and makes them the ideal choice for ultra-high-performance liquid chromatography (UHPLC) instruments or high end UV-Vis spectrophotometer.

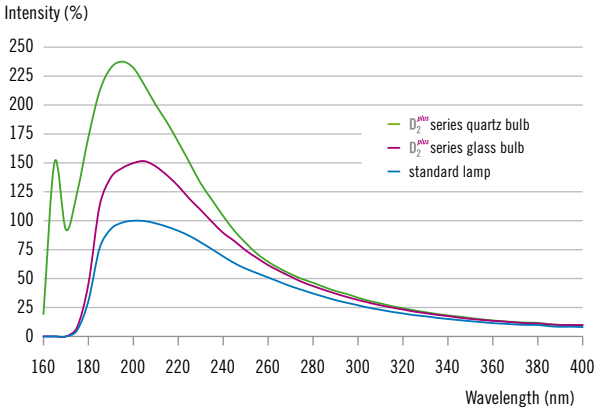
Features and Benefits

- Less instrument recalibration due to consistent intensity over lifetime
- Higher throughput due to shorter sampling times resulting from better signal to noise ratio
- Highest precision analytical results due to lowest noise and high intensity
- Best price / performance ratio and lowest Cost of Ownership due to long lifetime
- Available with 0.5 and 1.0 mm apertures for more focused intensity

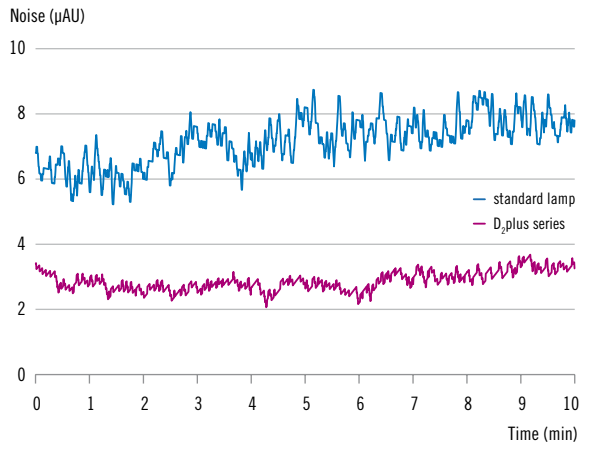
Heraeus' latest generation deuterium lamps serve different needs and applications:

- **Enhanced Lifetime Performance (ELP) technology**
  Heraeus' high transmissive synthetic quartz envelope maintains twice the intensity compared to standard D_2 lamps at the end of life. The patented ELP coating protects the light filament against degradation caused by VUV radiation and reactive plasma components.
- **See-through versions of all lamps available**
  See-through lamps offer a straight-line arrangement of a tungsten halogen lamp and a deuterium lamp in an optical system. This enables OEMs to simplify and reduce costs of UV-Vis spectrophotometers. For example, this approach can eliminate the need for a moveable mirror or a semi-transmissive beam splitter. See-through lamps offer the same unmatched high stability and are available with the same diversity of heater voltages and aperture sizes.
- **Different spectral ranges available**
  lamps are available either with UV glass envelope (cut off at 185 nm) or with high transmissive quartz envelope (cutting edge 160 nm), providing maximum performance depending on your applications or instrument design.

Spectral Comparison D_2^{plus} Deuterium Lamp



Optical Stability at 254 nm



D_2^{plus} Deuterium lamp with UV glass envelope

D_2^{plus} Deuterium lamp with quartz envelope

Hollow Cathode Lamps

Stable light output and low noise characteristics for Atomic Absorption Spectrometry.

High concentrations of iron, cadmium, or zinc in drinking water can endanger human health. Likewise, toxic metal-containing elements, such as mercury, can contaminate soil, also endangering humans. One analytical method for determining and analyzing these toxic substances is Atomic Absorption Spectrometry (AAS). AAS provides quantitative and qualitative analysis of many elements such as metals or semimetals in mostly liquid solutions and solids.

Hollow cathode lamps (HCL) are discharge lamps designed for use in AAS. They consist of a cathode made from the element of interest, an anode and an inert filler gas contained in a glass envelope.

Heraeus offers the widest selection of single- and multi-element coded/non-coded in low and high-current, 37 mm and 50 mm lamps in the industry. They are designed for optimal performance by combining:

- Good chemical sensitivity
- High spectral response
- Stable light output
- Low noise characteristics
- Long operating and shelf life

Heraeus HCL are available both for OEMs and as a replacement lamp by discerning users the world over. The range includes standard lamps and data-coded versions for PerkinElmer and Thermo Fisher Scientific AAS instruments..

Single-Element Lamps
The Heraeus catalogue includes 70 single-element lamps in standard 37 mm (1½ inch) and 50 mm (2 inch) diameters to fit almost any AAS instrument. All cathode materials are selected from the highest purity available – usually 99.99 % or better – to ensure high spectral line intensity, stability and low noise with good analytical sensitivity. Window material selection ensures optimal transmission of the cathode element's primary spectral lines. Borosilicate glass is used for wavelengths over 350 nm, and high quality quartz for shorter wavelengths.

Multi-Element Lamps
Heraeus manufactures the largest range of multi-element lamps offering only those combinations which provide sufficient energy and an acceptable lifetime for each element with no spectral interference. Multi-element HCL are available with two to seven different element combinations. These are particularly useful for carrying out routine analysis on a number of different elements in the same sample, such as alloys.

Features and Benefits

- Widest range of Single Elements available – no restrictions on optimizing your analysis
- Extensive Multi-Element range – simplifies routine analysis and saves set-up costs
- Coded lamps available – automatic optimized operation enables widest use in your laboratory
- Lamps available for all AAS systems – save time looking for suppliers
- Good chemical sensitivity – provides accurate analysis
- Stable light output – more reliable analysis results
- Long lifetime – reduces operating costs

Hollow Cathode

Tungsten Halogen and Mercury Lamps

Unique light sources for medical, pharmaceutical or industrial applications.

Medical, pharmaceutical or industrial use – Tungsten Halogen lamps from Heraeus are used in a diverse range of applications and industry sectors.

Tungsten Halogen (TH) lamps are typically used in visible spectrophotometers in the analytical and medical markets for measuring concentration levels, impurities, and chemical kinetics, just to name a few applications. Key benefits of Heraeus' TH lamps are long life, high color temperature and luminous efficacy, and high transmission below 380 nm.

These two factors lead to a high transmission of light at wavelengths below 380 nm, a high colour temperature and luminous efficacy, and long lamp life. Where a more precise analysis is required, Heraeus Tungsten Halogen lamps are also used in conjunction with Heraeus Deuterium lamps in UV-Vis spectrophotometers and high-performance liquid chromatography (HPLC).

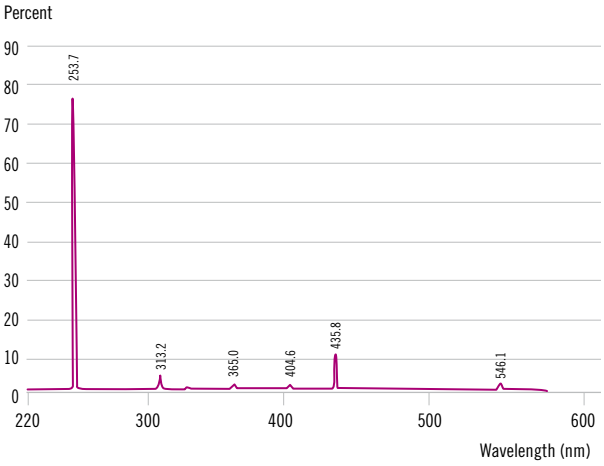
TH lamps are filled with a halogen gas mixture specific to their final application and range from 5 W – 200 W, with typical lifetimes of more than 2,000 hours. Lamps can be designed and built according to OEMs' specific requirements, such as colour temperature, voltage, wattage and mechanical tolerances. Each lamp is purpose-built, ready to drop into the instrument, no pre-selection required.

Heraeus offer two mercury lamps, the HG-2 and the Herapen. The HG-2 are commonly used in high performance liquid chromatography (HPLC) and high-performance thin-layer chromatography (HPTLC). The Herapen lamp's unique shape and size make it ideal for use in small apertures for water disinfection or water analysis for example.

The Heraeus HG-2 lamp has a highly stable output also predominantly at 254 nm. When used with the Heraeus C430 power supply, the line output is much higher than that of a Deuterium lamp, but with comparable stability. Therefore the HG-2 is the ideal choice for high stability applications such as mercury analyzers. Other lines, which total 20 % of the output, are at 313 nm, 365 nm, 405 nm and 435 nm.

The Herapen is available in 71 mm and 22 mm lengths, with the latter supplied as an ozone emitting, or ozone-free version. The Heraeus Herapen offers 10,000 hours at 254 nm, and an unrivalled lamp lifetime of over 30,000 hours at 185 nm.

Spectrum HG-2 Lamp



Features and Benefits

Tungsten Halogen Lamps
- Critical filament alignment for optimal analysis

Mercury Lamps
- High stability and long lamp life for cost-effective consistent analysis

Tungsten Halogen Lamps

HG2 Herapen*

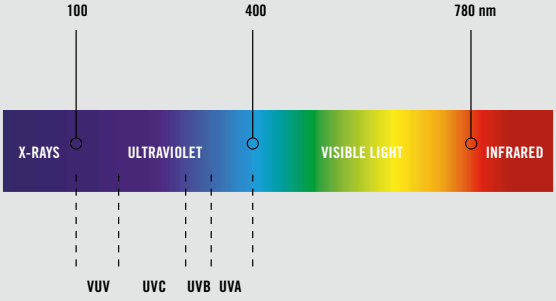
*Emitting length can be customized

The incredible power of light®

Photonics-based solutions from ultraviolet to infrared

HNG OAO7EN/02.19 / wsp

Heraeus Noblelight covers the total spectrum of technically usable wavelengths and can help find the optimum light system solution to suit specific processes. Whether you wish to optimize existing applications or win new markets, we offer efficient, well thought-out and long-life solutions that give you a lasting competitive advantage.



Heraeus Noblelight is part of the Heraeus technology group, a globally active family-owned enterprise. Within the Heraeus group, we have direct access to fundamental technologies and high-quality materials such as quartz glass, important precious metals and specialty materials. Rely on the acknowledged Heraeus quality!

High-quality light source solutions for optical and analytical instrumentation

- instrument-specific to match the performance of the instrument
- engineered for a long lifetime, which supports the lowest Cost-of-Ownership in your system
- developed for the highest repeatable precision so users benefit from the most consistent and sensitive analysis

Your analysis will be more consistent and benefit from a higher degree of confidence in chemical detection by using our advanced capabilities.

Functional security and reliability for your analysis
Comprehensive testing of all our light sources ensures they meet specifications in terms of intensity, ignition, voltage and life-time.

Uniquely positioned with the widest range of specialist analytical lamps, Heraeus can supply high quality lamps for all leading instrument brands. Our worldwide sales and dealer network ensures easy and quick lamp delivery.

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