Why is a good PID lamp important?

This technical note explains PID lamp spectra and the key technologies that ensure a good PID lamp performance and reliable quality over the whole life time.

What makes a good PID lamp... and why is this important? PID (photoionisation detector) lamps are gas discharge lamps that are driven either in DC or RF mode. DC PID lamps tend to be used in gas chromatography, whilst the electrodeless RF lamps are used in modern highly energy efficient, portable gas detectors. These lamps are essentially a small discharge tube with an exit window made from a suitable medium to transmit the required vacuum ultravio- let photons needed for Photoionisation Detection. Using a combination of window materials and filling gas, a number of tailored photon energy lamps can be manufactured for specific PID applications.

For example: Kr gas used in combination with a MgF2 crystal window gives both 10.0eV and 10.6eV photons. If a CaF2 window is used, then only the 10.0eV is emitted from the lamp. Xe gas with a MgF2 window gives both 9.6eV and 8.4eV photons.

The main challenge for lamp manufactures has been to produce dimensionally small, high quality, sealed lamps with precise operating characteristics that are maintained over useful life to match field application requirements. To achieve the unrivalled performance of Heraeus lamps in terms of intensity, sensitivity, and lifetime, it is necessary to use high quality materials and carefully controlled processing.

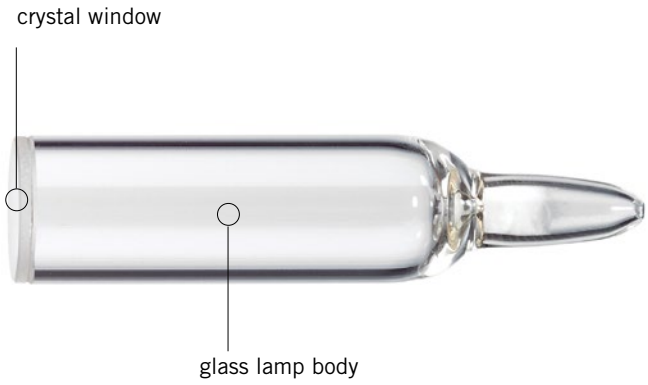

Fig. 1:
RF PID lamp (12,7 mm dia × 53 mm length)

Fig. 2:
RF PID lamp (6 mm dia × 14 mm length)

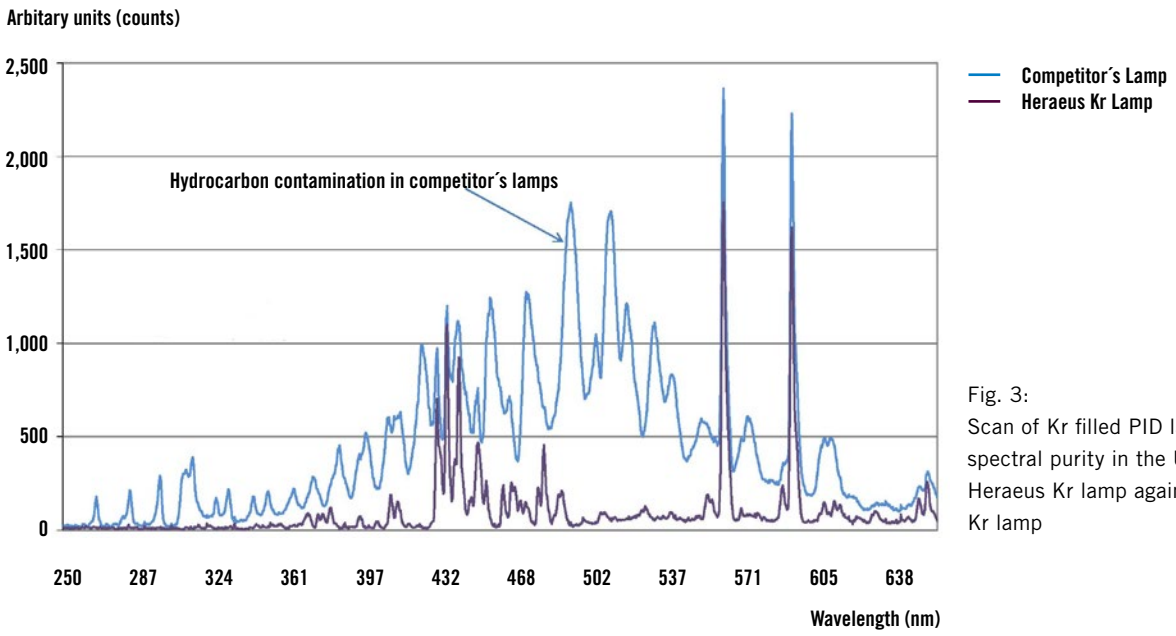

Fig. 3:
Scan of Kr filled PID lamps showing spectral purity in the UV-Vis region; Heraeus Kr lamp against a competitor's Kr lamp

Key Technologies for a good PID performance

Getters

These are metal inserts placed in the lamp that clean up the internal gas volume from all contaminants. Some manufacturers use a material that is active only during the processing of the lamp and some do not use any getter at all which results in a gradual deterioration of spectral purity over the lifetime of the lamp. While this does not interfere with the VUV lines for detection of VOCs, the contamination does take some of the energy from those lines resulting in decreased sensitivity and shorter life times. The proprietary gettering material used in Heraeus lamps is effective over the whole life time of the lamp to ensure continuing high spectral purity.

Window material

Many other PID manufacturers use natural crystal which contains contamination. This results in degradation from the high energy photon together with light scattering which reduces intensity and useable life. Heraeus lamps are manufactured using high grade single crystal magnesium fluoride, processed and cut in a plane to allow maximum transmission.

Window sealing and lamp processing

The use of carefully selected sealing material ensures a vacuum tight seal with no outgassing to lead to ingress of air or contamination. Tightly controlled processing is necessary to remove any contamination from the lamp body followed by filling with high purity gases. Lamp sealing is important to maintain the gas pressure within the bulb to produce the same performance with lamp-to-lamp repeatability.

Features

- Tailored eV photon energy range available
- Proprietary sealing and getter technology
- Stringent manufacturing techniques
- Designed to ensure spectral purity

Benefits

- Extended lifetime ≥ 6000 hours means reduced Cost of Ownership
- Consistent lifetime performance – reliable and less recalibration
- Materials and manufacturing controls ensure lamp-to-lamp repeatability

Dimensional Tolerances and sealing

A PID lamp must be manufactured to precise tolerances to ensure good sealing between the lamp and the measuring electrode stack. It is important to ensure that the annular seal is in good condition and that the electrode stack and lamp are parallel with each other: variable pressure across the face of the PID can lead to a non-parallel gap, causing unreliable readings.

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