

DDC NEWSLETTER

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The article on Mercury Lamps from the last few issues is continued below. (article by Bob Donofrio and Bob Eckel)

ENVELOPE MATERIALS CONTINUED

Titanium Doped Quartz (Hg OZF) is available in different grades with different cut off wavelengths for each grade as we have said previously, it prevents ozone formation and is less expensive than Cerium Doped Quartz but does solarize.

Lastly, we have Suprasil Quartz (or man made synthetic Quartz). This more expensive quartz is used when maximum transmission and output of the shortest wavelength radiation is required (as in the case with DUV lamps). Synthetic Quartz or Suprasil Quartz has high purity with a transmission cut off at 160 nm). It is also free from solarization. (Note that, Solarization is a color change in the quartz associated with the formation of Color Centers in the material and also is seen as a purple color which is also associated with presence of Fe, Al, Ge & other rare earths). The solarization reduces transmission mostly in the UV.

MECHANICAL COMPONENTS

TUBING

Usually, the quartz tubing has about a one mm wall thickness. But for internal diameters larger than 12mm, the wall thickness is increased to 1.25 -1.5 mm. If the wall thickness was to exceed 2.5 to 3mm then high thermal gradients may give rise to forming stress cracks.

SEALS

Today, two types of hermetic seals are employed in the manufacture of arc lamps for microelectronics applications. These are rod seals and ribbon seals. The rod seal consists of a tungsten rod made as thin as practical. A section of the rod is coated with

a "Sealing Glass" that has an expansion coefficient midway between tungsten and quartz. The quartz of the lamp body is then melted or sealed to the special "sealing glass bead" on the tungsten rod. For the capillary lamp the tungsten rod is approximately 0.765 mm (0.030") in diameter and serves as the electrode. The electrode tip protrudes a fraction of an inch, beyond the pool of mercury (at the ends of the lamp). On the outside of the lamp the tungsten rod is connected to the lamp base or electrical contact. The second type of seal used in the manufacture of the mercury arc lamp is much more sophisticated. This seal consists of a thin molybdenum strip or ribbon (or a multiple group of them). By various techniques these ribbons are fused into the quartz tubing. One end of molybdenum (Mo) strip is connected to the tungsten electrode and the other end to then electrical input. The Mo ribbons are quite thin usually between 15.2microns (0.0006 ") and 51microns (0.002 ") thick. The quartz is sealed around the ribbon is thick enough to impart mechanical strength to that region. Although the Mo metal has a higher coefficient of expansion than the quartz, the use of the Mo Oxide layer between the ribbon and the quartz gives a wetting medium that produces the hermetic nature of the seal. The "Molybdenum ribbon seal" as it is known, is central to the manufacture of mercury arc lamps. Because the electrodes and seals can be constructed so that there is no volume behind the electrodes, mercury can be contained within the lamp envelope proper and control of the lamp size will produce a high temperature "cold spot". This "cold spot" will determine the pressure at which the arc will operate. For most short arc applications the cold spot will be between 550 deg C and 700 deg C. The pressure in the lamp will be the pressure of the mercury vapor at these temperatures.

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