

Function; short-cut description:

Step 1

An RF circuit is established by connecting an RF power amplifier to a ceramic resonator known as the 'puck'. In the centre of the puck is a sealed quartz lamp that contains metal halide materials and other gases.

Step 2

The puck, driven by the power amplifier, creates a standing wave confined within its walls. The electric field is strongest at the centre of the lamp, which causes ionization of the gases, creating a glow.

Step 3

The ionized gas in turn heats up and evaporates the metal halide materials forming an intense plasma column within the lamp. This plasma column is centered within the quartz envelope and radiates light very efficiently.

In essence plasma lighting consists of a discharge lamp without electrodes, where the power is transferred from outside the lamp enclosure via high frequency electromagnetic radiation. It is a lighting technique that has been around in different forms for many years.

The first commercial plasma lamp was an ultraviolet curing lamp with a bulb filled with argon and mercury vapour. That lamp led to the development of the sulphur lamp, a bulb filled with argon and sulphur that is bombarded with microwaves through a hollow waveguide. The bulb had to be spun rapidly to prevent it burning through.

Sulphur lamps, though relatively efficient, have had a number of drawbacks, chiefly:

- Limited life – magnetrons had limited lives.
- Large size
- Heat – the sulphur burnt through the bulb wall unless they were rotated rapidly.
- High power demand – They could not sustain a plasma in powers under 1000W.

2.12.1 Limited Life

In the past, the life of the plasma lamps was limited by the magnetron used to generate the microwaves.

Solid state RF chips can be used and give long lives. However, using solid-state chips to generate RF is currently an order of magnitude more expensive than using a magnetron and so only appropriate for high value lighting niches. It has recently been shown that it is possible to extend the life of magnetrons to over 40,000 hours, making 'low-cost' plasma lamps possible.

