

Illuminents

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Thermal radiator

Filament bulb

Functional principle: The metal wire is heating by electricity at 2400 K and begins to glow. The theoretical maximum for a thermal radiator is at 6600 K with a light efficiency of 95 lm/W. But there is no conductive material which has a melting point bigger than 4200 K. Tungsten has a melting point at 3700 K this makes a light efficiency of 55 lm/W, but the problem is the sublimation of tungsten at high temperature. So to get a lifetime of 1000 h the glow filament is heating up to 2400-3100 K with a light efficiency of 8- 17 lm/W.

Halogen lamp

The combination of the halogen gas and the tungsten filament produces a chemical transport reaction, the so called halogen cycle. This transport reaction increases the lifetime of the filament and prevents darkening of the bulb. When the tungsten filament is heating, tungsten sublimates and reacts with the halogen gas to a complex at cooler zones. When the complex comes close to the filament, to the hotter zone, it dissociates again. Due to this reaction a halogen lamp can be operated at a higher temperature than a filament bulb. Because of the higher operating temperature the light efficiency increases at 25 lm/W.

Halogen lamp with IR- technology

The light efficiency can be enhanced by superimposing a coat of interference filter at the bulb wall. The interference filter lets pass visible light but reflects IR radiation. This results in a light yield of 35 lm/W.

Gas discharge lamp

The lamps are filled with noble gas or gas mixtures and additional materials like Hg, Na and metal halides. The gas is ionized when the lamp is in operation. The electrode (W) emits electrons which are accelerated by the electrical field in the tube. The free electrons collide with gas and metal atoms, which are get excited to a higher energy state due to the collisions. When the excited atom falls back to a lower energy state, it emits a photon with a

characteristic energy. The result is UV-, IR- or VIS radiation. Some lamps have a fluorescent coating inside on the glass surface to convert the UV- radiation into visible light.

Metal halide lamp

Metal halide lamps are filled with Hg, Ar and different metal and halogen components. A distinction is drawn between multi line emitter, molecule emitter and tree band emitter. The combination of the different compounds produces a halide cycle process: the vaporised metal halide compounds dissociate in the hotter plasma zones at different temperatures in metal atoms, halogens and ions. In the hot plasma center the particle get excited and they illuminate. Via convection and diffusion the species get transported into cooler zones, where they recombine with halogens.

Semiconductor

Light emitting diode

Light emitting diodes are produced of semiconductors, which built a diode. A diode is a two terminal electronic component that conducts electric current in only one direction. LEDs are composed of two layers of semiconductors. One layer has a electron excess (n- layer) and the other layer has a electron defect (p-layer). When the n-p body is fed with voltage in direction of flow, then there flows current from the n- layer to the p- layer.

Literature

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