SILICON LEDS FOR MIDDLE AND FAR IR (3-12 μm)

Description

LED operation is based on control over semiconductor emittance when the crystal and ambient temperatures are different. The emittance is modulated by varying the concentration of free charge carriers in the crystal. In the initial state, an active semiconductor element (being in thermal contact with a heater) is highly transparent in the spectral region corresponding to free charge carrier absorption and, correspondingly, has low thermal emittance. An increase of charge carrier concentration at their injection leads to increase of emittance. At a certain value of control voltage, the spectrum and emittance of the radiation source are the same as those of blackbody at the same temperature. The feature of the radiation source is that it can serve for simulation of blackbody with internal modulation of emittance.

Basic technical specifications:

Spectral range	3-12 μm
Emittance	10^{-3}-10^{-2} W/cm^2
Response time	10^{-4}-10^{-5} s
Operating temperature range	300-400 K
Emitting area	0.5x0.5-1.8x1.8 mm

Innovative Aspect and Main Advantages

Contrary to the traditional short-wave luminescence LEDs, the Si-based radiation sources operate at high temperatures in middle and far IR. They are characterized by high stability and speed of operation and large emitting areas, produce light fluxes of positive and negative contrasts, and can be made in single- and multi-element versions. High manufacturability of Si (the main material of microelectronics) is of use when producing LEDs, thus resulting in low cost of emitters and possibility of quick large-scale manufacturing of low-energy IR radiation sources that are much in demand.

Areas of Application

The IR radiation sources made on the basis of Si are intended for operation in the systems of optical processing of information. They can be applied also to monitor the parameters of photo detectors, as well as in the gas analysis systems and optoelectronic facilities. Due to high stability of their performance parameters, they can serve as reference radiation sources.

Such radiation sources may find various applications in chemical, oil, gas, and coal-mining industries (IR spectroscopy, thermo vision systems, automation of technological processes, alarm systems, gas analysis, measuring instruments etc.).

Fig.1. Si LEDs

Fig.2. Si LED array

Stage of Development

Prototypes - laboratory tested.

Contact Details

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