

Lifetime Tests

Room temperature lifetime tests were performed with InGaAs homojunction diodes un-encapsulated and encapsulated at current pulses of 2A, duration 50 μ s and repetition rate of 30 Hz.

Lower figure presents data on the long-term variation of the properties of the uncoated InGaAs homojunction LEDs at high temperatures. The upper graph shows the times for which the LEDs under study operated at several ambient temperatures. The samples operated at currents $I = 0, 0.5, 1, 2$ A for 150 h at room temperature, 450 h at $T = 130^\circ\text{C}$, and 800 h at $T = 180^\circ\text{C}$. The LEDs were cooled to room temperature and heated again to $T = 130^\circ\text{C}$ eight times and to 180°C three times.

The lower graph shows the output power as a function of the working time. As can be seen, the output power decreased, on average, by 25% after 1400 h of operation. It is noteworthy that the operating current strength has no effect on the degradation of the LEDs. With increasing operating time, the reverse currents at a bias $U = 1$ V increased from 0.5–1 mA (0 h) to 3–4 mA (1400 h). On “cleaning” the sample surface by etching in CP-4, the reverse current returned to its initial values, and the output power tended to regain its initial value: $P(1400\text{ h}) = (0.85\text{--}0.9)P(0\text{ h})$.

This confirms that LED encapsulation or by protection with window should increase LED lifetime at elevated temperatures.

