InAlGaP red emitting LEDs under extremely high pulsed pumping

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100 words

Commercial Osram red (620 nm) InAlGaP Golden Dragon cased high power LEDs are studied under extremely high pulsed pump current density up to 4.5 kA/cm^2 and pulse durations from microsecond range down to sub-nanoseconds. No decrease of efficiency is observed in the whole range of drive currents at nanosecond-range pulses with duty cycles well below 1%. Very low red shift of the peak wavelength (<1nm) is observed at these conditions that suggests negligible overheating of the active region. This suggests the active region overheating to be the main mechanism for the LED efficiency decrease at high pumping.

250 words

In this work we study the commercial Osram red (620 nm) InAlGaP Golden Dragon cased high power LEDs under extremely high pump current density up to 4.5 kA/cm^2 and pulse durations from microsecond range down to sub-nanoseconds. At short-pulsed pumping of 1s nanoseconds and duty cycles well below 1% we observe no decrease of efficiency in the whole range of drive currents. We also observe very low (<1nm) red shift of the peak wavelength of the LED emission at these conditions that suggests very low overheating of the active region despite of extremely high pumping. Under the longer-pulsed pumping of 100s nanoseconds we observe both the fast-term component of the crystal lattice heating (noticeable on the duration of the pulse) and the long-term counterpart (present on the period between the pulses). The last component can be easily eliminated by reducing the duty cycle below 1%, while the effect of the fast-term heating is not noticeable up to the pumping of 100s A/cm^2. At higher pumping the red shift of the centroid wavelength of the LED emission becomes noticeable and the efficiency decreases. This suggests the active region overheating to be the main mechanism for the LED efficiency decrease at higher pumping.