

B-8-2
(INVITED)

Degradation in Semiconductor Light Sources

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Since last year studies on bulk as well as surface degradation in diode lasers or LEDs have made remarkable progress. Accelerated life tests at elevated temperatures in (Al.Ga)As or GaAs LEDs indicated that the operating life of these devices at room temperature will be around 10^6 hours. Recent studies showed that life of (Al.Ga)As diode lasers, which is presently about 10^4 hours, seems to be limited mainly by a gradual degradation of the crystal surface at the laser mirror. Proper passivation of the crystal surface has resulted in lasers with no detectable degradation over thousands of hours. Structures and operating conditions are quite similar in (Al.Ga)As LEDs and laser diodes. Thus it is becoming clear that no intrinsic limitation in diode laser life time at least up to 10^6 hours, when the surface degradation is eliminated.

Gradual formation of line defects and point defects in the bulk of dislocation free crystals will be responsible for the gradual degradation in 10^6 hours range observed in LEDs. Studies on these defects in bulk as well as surface degradation will be reviewed.

Early observations on (In.Ga)(As.P) light sources show different degradation behavior from that of the (Al.Ga)As source. Difference in material parameters may present a new interest in the field of the degradation study.