

Laser diode degradation: mechanisms and defects

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The degradation of laser diodes is a severe problem for the laser makers, but it is also a very relevant defect physics problem as it involves optical, mechanical and thermal issues. We present herein a description of the main defects associated with the laser degradation, but also the principles of formation and propagation of the main products of the degradation, the so called dark line defects (DLDs). The DLDs are created during the laser operation leading to the failure of the device. We analyze here the degradation of different lasers, in particular, 980 InGaAs/AlGaAs monomode lasers, 450 nm InGaN/GaN lasers, and 808 nm broad area AlGaAs/GaAs lasers. The defects generated during the laser operation are revealed by cathodoluminescence (CL). From the analysis of those defects one can establish mechanisms of degradation, and the trends of propagation of the defects forming the DLDs. Thermal strain, laser radiation self- absorption, local collapse of the thermal conductivity, and thermal lensing are the mechanisms inducing the defect formation and propagation leading to the device failure.

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