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SEMINARANKÜNDIGUNG

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„Optical gain in polar and semipolar (Al,In)GaN laser diodes”

(Al,In)GaN laser diodes have been developed for the spectral region from green to ultraviolet, moderately high output power, and short pulses. They are being used in commercial applications, first of all in blue-ray disk drives, but also in compact laser projectors. The progress of these short wavelength laser diodes has been driven by a fast development of (Al,In)GaN epitaxy and processing technologies. Gain spectra of these short wavelength (Al,In)GaN laser diodes are essentially different from those of red or infrared laser diodes based on other III-V material combinations. The gain spectra of (Al,In)GaN laser diodes suffer from large inhomogeneous broadening, in particular towards longer wavelengths, and consequently a lower differential gain. Due to large piezoelectric polarization of the strained quantum wells, the Quantum confined Stark effect (QCSE) causes a different dependency of the peak gain on carrier density and bias voltage. In semipolar (Al,In)GaN laser diodes, birefringence causes modes which have a tilted polarization with respect to TE or TM modes, which effects the selection rule for the transition matrix element and consequently for the gain spectra. We demonstrate how with a combination of characterization methods the parameters are determined which are necessary to describe the optical gain, modal and dynamical behavior of (Al,In)GaN laser diodes, both for the optimization of laser diodes ranging from violet to green and towards picosecond pulse operation.

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