Simulation of a Ridge-Type Semiconductor Laser with Horizontal Coupling of Lateral Modes

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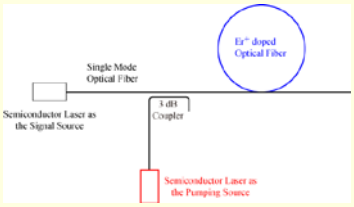
Abstract

A ridge-type semiconductor laser with horizontal coupling of lateral modes is proposed, and lasing characteristics are simulated. It is found that kink-free operation is obtained.

Application

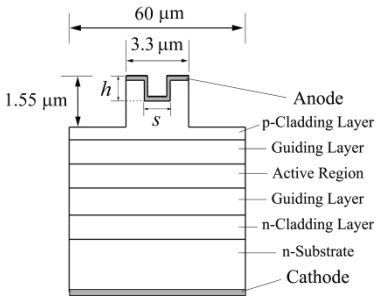


High power 980-nm semiconductor lasers are pumping sources of Er^{+} doped optical fiber amplifiers.

Background of This Research

In high power 980-nm ridge-type semiconductor lasers for pumping sources of Er^{+} doped optical fiber amplifiers, higher-order transverse modes lase with an increase in injected current; kinks appear in their current versus light-output (*I*-*L*) curves. To obtain high fiber-coupled optical power with low power consumption, semiconductor lasers with kink-free operation in the fundamental transverse mode and low threshold current are required.

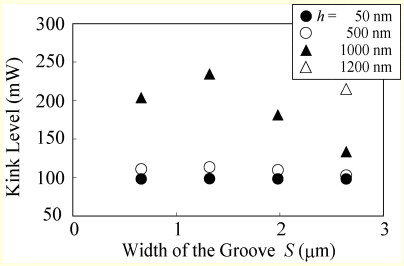
Proposed Structure



Schematic cross-sectional view of a proposed ridge structure with horizontal coupling of lateral modes.

A groove is formed in the center of the mesa and two ridges are formed. Here, *S* is the width of the groove in the mesa and the space between the two ridges; *h* is the depth of the groove in the mesa and the height of the two ridges measured from the bottom of the groove.

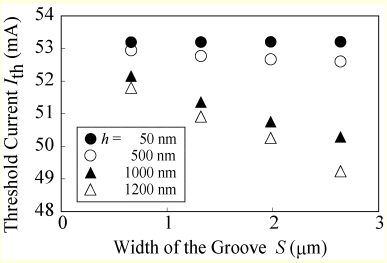
Kink-Free Operation



With an increase in the depth *h* of the groove, the kink levels increase. When *h* is less than 1000 nm, the kink levels are the highest at S=1.32 μm.

For *h* = 1200 nm, kinks do not appear when *S* is less than 1.98 μm up to the injected current of 2 A.

Low Threshold Current



The threshold current decreases with an increase in the depth *h* of the groove. When *h* is larger than 500 nm, the threshold current decreases with an increase in the width *S* of the groove.

Summary

A novel ridge structure with horizontal coupling of lateral modes by a groove in the mesa was proposed and the laser characteristics were simulated.

Kink-free operation with relatively low threshold current was obtained.