On-chip Broad-area Semiconductor Lasers for High Power, High Brightness Applications

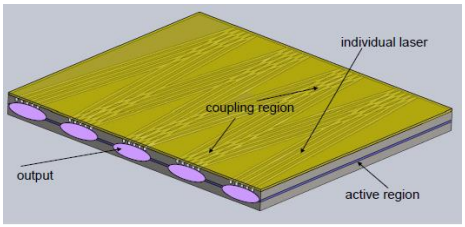
Description:

Semiconductor diode lasers provide many unique advantages over other laser systems, such as a wide range of operation wavelengths, high electrical to optical conversion efficiency, high compactness, and low cost. On the negative side, high power, high brightness (diffraction-limited beam quality) operation is difficult to obtain due to highly nonlinear materials and strong coupling between gain and index. Today, broad area diode lasers are usually used for high power applications, such as material processing and pumping sources for solid-state and fiber lasers. Higher optical power and brightness can be obtained through laser beam combining. There are two main beam combining techniques: coherent beam combining (CBC) and spectral beam combining (SBC). Although current SBC and CBC systems can provide high diffraction-limited power, they cannot be monolithically implemented and are inefficient, complex, bulky, and expensive. Furthermore, it is very difficult to apply these techniques for diode laser arrays.

This invention features high power, high brightness broad area semiconductor lasers with diffraction-limited beam quality without any external optical components or differential phase feedback mechanisms through use of an angled grating confined broad area laser as the building element and take advantage of its zig-zag mode profile. By evenly interleaving two symmetric grating confined laser arrays with opposite tilt angles, direct optical coupling can be obtained, induced by Bragg diffraction, between any two adjacent elements.

Applications:

- Free space communication and remote sensing
- Laser radar arrays
- Laser weapons
- Pumping sources for high energy laser systems



Benefits:

- Converts an array of incoherent broad area lasers with poor beam quality to a single high power, high brightness laser
- Enhanced system efficiency

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