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Review

Optically pumped planar waveguide lasers: Part II: Gain media, laser systems, and applications

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Abstract

The field of optically pumped planar waveguide lasers has seen a rapid development over the last two decades driven by the requirements of a range of applications. This sustained research effort has led to the demonstration of a large variety of miniature highly efficient laser sources by combining different gain media and resonator geometries. One of the most attractive features of waveguide lasers is the broad range of regimes that they can operate, spanning from continuous wave and single frequency through to the generation of femtosecond pulses. Furthermore, their technology has experienced considerable advances to provide increased output power levels, deriving benefits from the relative immunity from the heat generated in the gain medium during laser operation and the use of cladding-pumped architectures. This second part of the review on optically pumped planar waveguide lasers provides a snapshot of the state-of-the-art research in this field in terms of gain materials, laser system designs, and as well as a perspective on the status of their application as real devices in various research areas.

Keywords: Waveguides; Lasers and laser materials; Integrated optics devices; Laser applications; Photonic structures and devices; Nanophotonics and plasmonics

Contents

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1. Introduction

Beside the tremendous improvements in planar waveguide fabrication tools, which as discussed in the first part of this review [1] have given a major boost to the field of waveguide lasers, a great deal of research efforts directed toward the optimization of their operation characteristics, which are mainly determined by the gain medium and the laser resonator. In this respect, significant benefits have been derived from innovations and breakthroughs in the designs of both the laser materials and resonators, providing a large variety of performance characteristics and ensuring high efficiency and functionality.