

Rare-Earth-Ion-Doped Channel Waveguide Lasers on Silicon

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(Invited Paper)

Abstract—This paper reviews the recent developments in rare-earth-ion-doped channel waveguide lasers. Optical gain in rare-earth-ion-doped waveguides has been increased by two orders of magnitude to ~ 1000 dB/cm and waveguide lasers with extremely high slope efficiencies and output powers exceeding the Watt level have been demonstrated. Of particular interest in integrated optics is the recent integration of rare-earth-ion-doped channel waveguide lasers in amorphous materials directly deposited on a silicon substrate. Remarkable performance with respect to slope efficiency, output power, and laser linewidth has been achieved.

Index Terms—Amorphous materials, CW lasers, dielectric waveguides, distributed Bragg reflector lasers, distributed feedback lasers, integrated optics, optical amplifiers, planar waveguides, rare earth compounds, solid lasers.

lasers can be found in Ref. [15]. In the following section the potential advantages of rare-earth-ion-doped waveguide amplifiers and lasers over their semiconductor and bulk dielectric counterparts will be outlined. In the main parts, our recent results on rare-earth-ion-doped waveguide lasers in a polymer and in amorphous aluminum oxide, both deposited on a silicon substrate, will be reviewed.

II. GAIN IN RARE-EARTH-ION-DOPED DIELECTRIC WAVEGUIDES

Compared to previously reported results, the gain per unit length in rare-earth-ion-doped channel waveguides can be sig-