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All-Silicon Raman Laser with Quasi-Phase-Matched Structures and Resonators

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Abstract : The principle of all-silicon Raman lasers for an output wavelength of 1.3 μm is presented, which employs quasi-phase-matched structures and resonators to enhance the output power. 1.3-μm laser beams for GE-PONs in FTTH systems generated from a silicon device are very important because such a silicon device can be monolithically integrated with the silicon planar lightwave circuits (Si PLCs) used in the GE-PONs. This reduces the device fabrication processes and time and also optical losses at the junctions between optical waveguides of the Si PLCs and Si laser devices when compared with 1.3-μm III-V semiconductor lasers set on the Si PLCs employed at present. We show that the quasi-phase-matched Si Raman laser with resonators can produce about 174 times larger laser power at 1.3 μm (at maximum) than that without resonators for a Si waveguide of Raman gain 20 cm/GW and optical loss 1.2 dB/cm, pumped at power 10 mW, where the length of the waveguide is 3 mm and its cross-section is (1.5 μm)2.

Keywords : All-Silicon Raman Laser, FTTH, GE-PON, Quasi-Phase-Matched Structure, resonator
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