Single-mode semiconductor laser with high order surface gratings

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A single-mode semiconductor lasers have found wide application in fiber-optic communications as a transmitter. The main requirements in such systems are high bandwidth, stable single mode performance, wide temperature range of operation, simple fabrication and overall low cost. Latter ones crucial requirements and the lasers which can be monolithically integrated with other photonic devices are desirable.

In this work we present a characterization of a single-mode semiconductor laser based on high order surface gratings or so-called slots which are etched into the ridge of the laser waveguide. These slots act as an active distributed Bragg reflector (DBR) of the laser to provide sufficient reflection. By optimizing slot parameters in terms of slot width, depth, spacing and number we can obtain stable single-mode lasing with low threshold current. For optimization 2D scattering matrix method was used. From the analysis it was found that slot width is around 1µm which makes the laser compatible with standard photolithography for simple fabrication.

We have studied main laser diode characteristics such as electrical and spectral characterizations. These studies show relatively low threshold and high output power. The emission spectrum from the laser shows stable single-mode operation which was a good agreement with our design. Finally, single-mode laser integrated with semiconductor amplifier (SOA) is successfully demonstrated. This makes these lasers be monolithically integrated with other photonic components such as modulators.