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Abstract

Semiconductor nanolasers with metallo-dielectric cavities are considered as promising light sources for optical interconnects. We review the first demonstrated devices of this type and outline our current research efforts on a waveguide-coupled nanolaser.

I. Introduction

Semiconductor nanolasers provide an attractive route towards high density photonic integrated circuits in low power applications such as optical interconnects. Such lasers exploit metallic and dielectric confinement to provide high quality factors in wavelength-scale cavities, that provide efficient cooling and cross-talk immunity due to the metal coverage. We demonstrated first devices operational at cryogenic temperatures in 2007 [1], and recently reported devices operating at room-temperature [2]. In a next step we are developing a waveguide-coupled nanolaser compatible with the integration in an InP-membrane photonic platform allowing more complex applications. The design is based on a pillar with rectangular cross section (300x400 nm^2) encapsulated with SiO_2 and a silver cladding. Initial simulations show promising characteristics with an expected operating wavelength near 1.55 μm, a high quality factor exceeding 500 and waveguide coupling efficiency better than 0.45. The nanoscale design results in a low threshold current below 100 μA, while output powers up to 100 μW seem feasible. We will present optical and electrical simulations and discuss the challenges of fabricating such nanoscale optical devices.

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References

[1] M. T. Hill, *et al.*, "Lasing in metallic-coated nanocavities", *Nature Photonics*, 1(10), pp. 589–594, 2007.
[2] M. T. Hill, "Status and prospects for metallic and plasmonic nano-lasers", *Journal of the Optical Society of America B*, 27(11), pp. 36–44, 2010.