PHOTONIC CRYSTAL RESONATORS AND LIGHT EMITTERS

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ABSTRACT

Characteristics electrically-driven single-cell photonic crystal lasers operating at room temperature and the all-fiber coupling with photonic crystal resonators are discussed.

In the electrically-driven photonic crystal structure, a sub-micron-size semiconductor post is placed at the central region of the single-cell resonator where the photon density is almost zero [1]. The thickness of the semiconductor slab is about a half the wavelength in the material. Electrons are supplied laterally from the top electrode while holes are injected directly through the bottom post. The carriers recombine in the InGaAsP quantum dots that are to be designed to have an electro-luminescence peak near communications wavelength of 1,300-1,500 nm. A doping structure that is inverted from that of a typical semiconductor laser is to be used to exploit the high mobility of the electrons that has to travel a longer distance. Threshold current of 0.26 mA is observed at room temperature.

In the all-fiber coupling scheme, photons are coupled directly into the micro-fiber without the help of conventional bulk optics. Experimental photon coupling efficiency in excess of 70% is realized [2]. Since the photon generator unit contains only a miniature photonic crystal resonator integrated with a micro-fiber, the final unit can be very simple and mechanically robust. When optically pumped using a 980-nm InGaAs diode lasers, this all-fiber coupled modified photonic crystal resonator lases with small threshold pump power of 25 µW and generates optical power larger than 10 nW.

REFERENCES