PHOTONIC CRYSTAL RESONATORS AND LIGHT EMITTERES

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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 output optical power larger than 10 nW.

REFERENCES

[1] H. G. Park et. al., *Science* **305**, 1444 (2004).
[2] I. K. Hwang et. al., *Appl. Phys. Lett.* **87,** 131107 (2005).