Actively wavelength tunable lasing over 130nm spectral range in a cholesteric liquid crystal cell by electrothermal effect

Mi-Yun Jeong [1,*] Hyeon-Jong Choi[1], and Keumcheol Kwak[2]

1 Department of Physics and Research Institute of Natural Science, Gyeongsang National University, Jinju-si 52828, Gyeongsangnam-do, South Korea; jmy97@gnu.ac.kr
2 Albatrace Inc., #813, 40 Omokcheon-ro 152 beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do, South Korea; daniel95@albatrace.com

Keywords: Active wavelength tunable laser, Cholesteric liquid crystal devices

In our research on a cholesteric liquid crystal (CLC) material with a negative dielectric constant, we have discovered the conditions for controlling the helical pitch of the CLC. This pitch control can be actively exercised through the electrothermal effect by altering the voltage intensity at a frequency higher than a critical value. By changing the pitch of the parallel CLC cell, which has a thickness of 25um, the wavelength of the laser line can be tuned over a 130.81 nm (from 550.41 nm to 681.22nm) spectral range depending on the applied low AC voltage of 5.4 V_{rms} or less at 3 MHz. However, due to the free spectral range of the parallel cavity structure of the CLC cells, the laser wavelength was tuned discontinuously. This particular CLC cell is constructed with ITO electrode substrates having a finite resistance of 10 Ω/□ and is filled with general CLC mixtures consisting of a nematic liquid crystal with negative dielectric anisotropy, a chiral molecule with supersaturated concentration (45 wt%), and two laser dyes of DCM and LDS698. The dynamic behavior of CLC molecules was studied as a function of the applied electric field intensity and frequency.

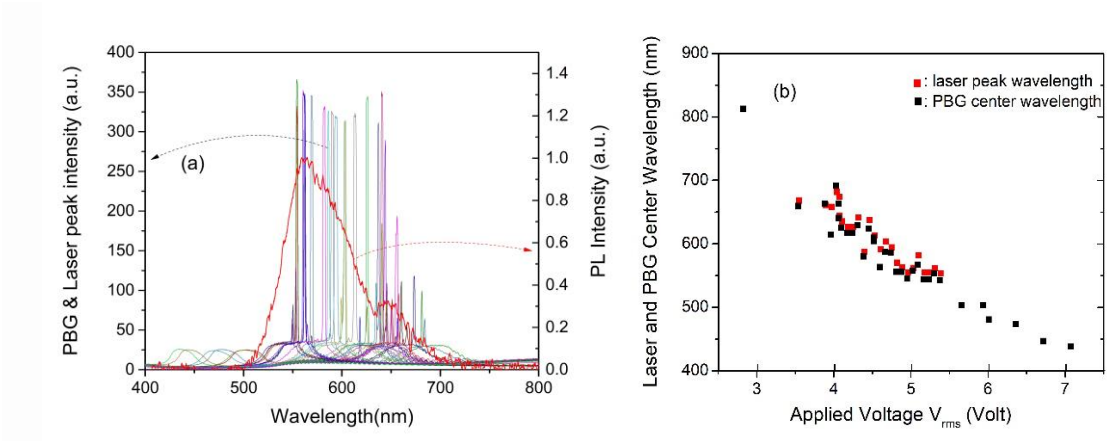

Fig. 1. (a) spectra of generated laser lines and photonic band gaps by changing AC voltage of 5.4 V_{rms} or less at 3 MHz and PL spectrum of the CLC cell. (b) laser peak wavelengths(■) and center wavelength of photonic band gaps (■) by changing AC voltage at 3 MHz.