**Oligofluorene as a New High-Performance Dye for Cholesteric Liquid Crystal Lasers**

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**Abstract:** We conducted comparative studies of laser characteristics of CLC doped with DCM dye and a new oligofluorene dye possessing the highest order parameter among all laser dyes. The latter demonstrated better absolute laser performance.

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Cholesteric liquid crystals (CLC), that can be obtained by mixing some amount of nematic and cholesteric additives, attract a lot of interest from the point of developing new laser media, because their band gaps can be adjusted in the fabrication process. When doped with organic laser dyes, CLC can be used as mirrorless distributed-feedback lasers [1, 2].

Some organic dyes have a tendency for their dipole moments to be highly aligned with respect to a local director of CLC host. These dyes are said to have high order parameters. They have an advantage over their counterparts with low order parameters: it is possible to achieve lower lasing threshold, and, potentially, better laser performance in CLC devices doped with such dyes [3]. So far, the dyes with the order parameters as high as 0.5 were used for CLC laser devices [3].

We report on detailed comparative studies of DCM-doped and oligofluorene-doped CLC laser elements with different dye concentrations. Oligofluorene (OF) in CLC has an order parameter of 0.76, which is much higher than that of the commonly used DCM dye (0.25).

We prepared and tested CLC devices with 0.21 and 0.5 wt. % DCM concentrations and 0.5, 1, 2, 3, and 5 wt. % OF concentrations. (The 0.21 wt. % DCM and 2 wt. % OF samples have equal dye molar concentrations.) The laser output as a function of the pump pulse energy is shown in Figure 1. The OF-doped CLC demonstrated a better absolute performance when pumped with 532-nm 35-ps laser pulses, providing higher output intensities and higher slope efficiency.

We also recorded polarized output spectra of the DCM-doped and OF-doped CLC devices at different pump levels. As we expected, the lasing of the DCM-doped CLC occurs at both edges of the band gap, while the OF-doped CLC output has a strong peak only at the low-frequency band edge because of the high alignment of OF dipole moment with respect to the local director.

**FIG. 1:** DCM and OF dye-doped CLC laser output.

