【QS-03】

Photonic Effect in Helical Liquid Crystals

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Photonic effect in crystals with a periodicity of visible wavelength has attracted much attention. Helical liquid crystal phases are interesting, since they spontaneously form ideal one-dimensional periodic structures. Here we report two photonic effects observed in the ferroelectric SmC* and dye-doped chiral nematic (N*) liquid crystals; (1) special phase matching of SHG in SmC* and (2) lasing of dyes in N*. Summary of these results are listed in the following.

(1) Special phase matching of SHG in SmC* Special phase matching of SHG was observed and/or predicted by simulation in helical SmC* phase.

(1-1) Using counterpropagating waves along the helical axis, enhanced circularly polarized SHG with the same handedness as the helix is observed, when the optical pitch of the helix coincides with the SHG wavelength. The SHG intensity depends on the fourth power of cell thickness[1,2].

(1-2) (1-2) Using a single wave propagating oblique to the helical axis, enhanced SHG is emitted to transmitted and reflected directions in the same wavelength condition as in (1-1) [3,4].

(1-3) (1-3) A single wave propagating along the axis of a helix is enough to give enhanced SHG when the helix is deformed by an electric field [5].

(2) Lasing of dyes in N* Lasing was observed in N*LCs doped with polymer dyes. This laser utilizes a DFB structure based on

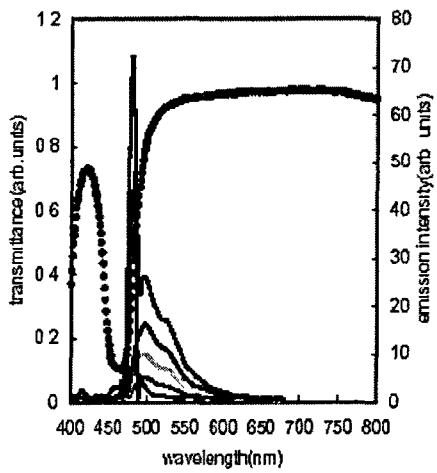

Fig. 1. Transmittance, emission and lasing spectra under various excitation intensities.

one-dimensional helical structure of N* as a cavity.

(2-1) Lasing always occurs at the lower edge of the photonic gap (see Fig. 1).

(2-2) Lasing wavelength was tuned by changing a temperature.

(2-3) Lasing threshold was as low as 0.018¥ìJ/pulse (1.44mW/cm2) of the incident light.