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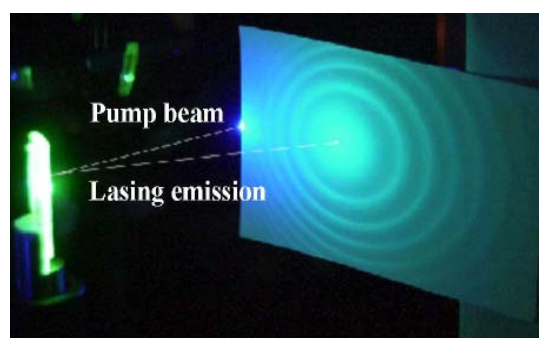
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Research field: Science and application of liquid crystals

Research topics conducted within the G-COE project

1. Liquid crystal photonic devices

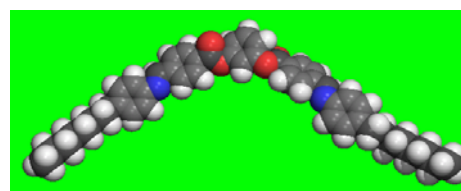
Optical devices such as lasers, optical diode, white-light reflector, tunable polarization devices, using periodic structures in liquid crystals (LCs). We realized wide-range wavelength tuning, RGB reflector and RGB simultaneous lasing using single-pitched cholesteric LCs. In OLED, improved external efficiency and low-loss polarization tuning have been realized. We will achieve further application such as cw lasing.



Lasing from dye-doped cholesteric liquid crystal cell

2. Science and Application

We discovered antiferroelectric liquid crystal (1989) and banana-shaped liquid crystal (1996) and brought about new fields of science of LCs. Both papers got about 500 times citation. We have found polar switching and spontaneous chiral segregation and its control in achiral banana-shape LCs. We aim further novel phases and application such as display and memory devices.



Banana-shaped liquid crystal

Representative publications

- “Antiferroelectric Chiral Smectic Phases Responsible for the Tristable Switching in MHPOBC”, A. D. L. Chandani, E. Gorecka, Y. Ouchi, H. Takezoe and A. Fukuda, *Jpn. J. Appl. Phys.* **28** (1989) L1265-L1268. (discovery of antiferroelectric LC: Japan Applied Physics Society Award)
- “Distinct Ferroelectric Smectic Liquid Crystals Consisting of Banana Shaped Achiral Molecules”, T. Niori, T. Sekine, J. Watanabe, T. Furukawa and H. Takezoe, *J. Mat. Chem.* **6** (1996) 1231-1233. (discovery of banana LC)
- “Bent-core Liquid Crystals: Their Mysterious and Attractive World” H. Takezoe and Y. Takanishi, *Jpn. J. Appl. Phys.* **45** (2006) 597-625. (Invited review article: Japan Applied Physics Society Award)
- “Electro-Tunable Optical Diode using an Anisotropic Layer Sandwiched by Hetero-Photonic Bandgap Cholesteric Liquid Crystal Films”, J. Hwang, M. H. Song, B. Park, S. Nishimura, T. Toyooka, J. W. Wu, Y. Takanishi, K. Ishikawa and H. Takezoe, *Nature Materials* **4** (2005) 383-387. (Optical diode)
- “Electric-field-induced Polar Biaxial Order in a Non-tilted Smectic Phase of an Asymmetric Bent-core Liquid Crystals” Y. Shimbo, E. Gorecka, D. Pochiecha, F. Araoka, M. Goto, Y. Takanishi, K. Ishikawa, J. Mieczkowski, K. Gomola and H. Takezoe, *Phys. Rev. Lett.* **27** (2006) 113901-1-3. (Principal of new fast banana LC display)