

# New Science and Functions in Liquid Crystals Formed from Bent-Core Molecules

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## **【 Outline of survey 】**

Smectic liquid crystals (bent-core mesogens) composed of bent-core molecules have attracted much attention from the following two viewpoints; (1) emergence of polar order due to closed packing of the bent-core molecules into a layer and (2) emergence of chirality due to the tilt of bent-core molecules with respect to the layer normal. In this project, we will study science and functions of the bent-core mesogen due to the above two viewpoints. In particular, we will clarify (1) mechanism of emergence of ferroelectric phase and (2) correlation between chirality caused by geometric origin and one caused by molecular conformation by means of nonlinear optic effect such as second-harmonic generation and sum frequency generation and spectroscopies such as polarized FT-IR, NMR and THz spectroscopy. As for (1), we want to clarify molecular interaction to realize ferroelectric molecular arrangement. As for (2), final goal is to provide methods to synthesize chiral molecules in achiral molecular field. For this purpose, we will examine the chiral formation process from achiral molecules using variety methods mentioned above. We also study the application of this unique liquid crystal system as fast switching devices and chiral nonlinear optic effect.

## **【 Expected results 】**

The bent-core molecules we are studying was originally thought to be bad molecules for liquid crystals. In reality, however, bent-core molecules brought about lots of treasures to materials science. The present project is along this research field, and moreover will be very significant for future progress of research. Bent-core mesogens have attracted attentions of scientists from fundamental viewpoints. If possible applications of photo- and electronic-functions will be shown, the research of the bent-core mesogens that can be easily synthesized will be further accelerated.

## **【 References by the principal researcher 】**

- “ Important role played by interlayer steric interaction for the emergence of ferroelectric phase in bent-core mesogens ”, K. Kumazawa, M. Nakata, F. Araoka, Y. Takanishi, K. Ishikawa, J. Watanabe, and H. Takezoe, *J. Mater. Chem.* **14** (2004) 157-164.
- “ Electrogyration Effect in a Chiral Bent-core Molecular System ”, F. Araoka, Y. Takanishi, H. Takezoe, A. Kim, B. Park and J. W. Wu, *J. Opt. Soc. Am. B* **20** (2003) 314-320.

**【 Term of project 】** F Y 2004 - 2008

**【 Budget allocation 】** 84,200,000 yen

**【 Homepage address 】** <http://www.op.titech.ac.jp/lab/Take-Ishi/index.html>