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Tutorial

Design of New Functional Liquid Crystals

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Molecular self-assembled soft materials are important as functional materials in the field of energy, environment, information, and healthcare. They form a variety of ordered and disordered structures in molecular-level scale. Liquid crystals are ordered and fluid soft molecular materials which can exhibit a variety of functions [1-6]. Nanometer-scale ordered and dynamic structures of liquid crystals are useful as materials. In this lecture, I describe design and function of liquid crystals. I also show some functional complex and hybrid liquid-crystalline (LC) materials based on liquid crystals [6,7].

Liquid crystals form nanostructures such as micellar cubic, columnar, smectic, and bicontinuous cubic phases. The mobile states and phase transitions of these materials can be used for induction of anisotropic and dynamic functions. For induction of these functions. it is important to control intermolecular interactions such as hydrogen bonding, ionic interactions, ionic-dipolar interactions, and pi-pi interactions. They exhibit electronic, photonic, ionic, mechanical, informational, sensing, and separation functions as well as bio-functions. New generation of liquid crystals with unconventional design such as supramolecular liquid crystals[1,2,4], liquid crystal gels [6], and hybrid liquid crystals[7] are also described.

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References (selected):

[1] Handbook of Liquid Crystals, 2nd ed., ed. by J. W. Goodby, P. J. Collings, T. Kato, C. Tschierske, H. Gleeson, P. Raynes, Wiley-VCH, Weinheim (2014).
[2] T. Kato, J. Uchida, T. Ichikawa, T. Sakamoto, *Angew. Chem. Int. Ed.*, 57, 4355 (2018).
[3] T. Kato, M. Yoshio, T. Ichikawa *et al.*, *Nature Rev. Mater.* 2, 17001 (2017).
[4] T. Kato, N. Mizoshita, K. Kishimoto, *Angew. Chem. Int. Ed.*, 45, 38 (2006).
[5] Y. Sagara, T. Kato, *Nature Chem.*, 1, 605 (2009).
[6] T. Kato, Y. Hirai, S. Nakaso, M. Moriyama, *Chem. Soc. Rev.*, 36, 1857 (2007).
[7] M. Nakayama, T. Kato, et al., *Nat. Commun.*, 9, 568 (2018).

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