

量子物理学・ナノサイエンス第 452 回セミナー

Non-Classical Chirality of Macromolecular Systems: Functions of Disordered and Non-uniform Polymers

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概 要

Ordering molecular and inter-molecular, uniform structures is recognized as important in attaining functionality of a wide range of organic and inorganic materials. On the other hand, we have found several cases in polymer science where disorder and non-uniformity play a role in attaining functionalities. One example is a chiral hyperbranched polyfluorenevinylene designed with inspiration from the fact that optically active natural polymers are often produced in hyperbranched forms, as exemplified by amylopectin and glycogen [1]. This polymer can form an inclusion complex with a large excess of external aromatic molecules without the formation of single crystals of the included molecules, and the amorphous inclusion system exhibits circularly polarized light (CPL) emission at a high anisotropy.

Another example is a chiral linear polyfluorenevinylene having single-handed helical conformation. This polymer bends its chain to form “turns” in the middle of chain, not in the vicinity of chain, and folds into a non-uniform structure in solution. Further, the polymer exhibits efficient CPL emission arising from the turn moieties [2]. These observations may imply that useful functionalities may be attained without relying on classical, highly regulated and uniform chiral structures of polymers represented by helix, as far as polymers are concerned [3]. It is worth investigating whether disordered and non-uniform structures play a role in materials science aiming at specific functions.

[1] Wu P, Pietropaolo A, Fortino M, Bando M, Maeda K, Nishimura T, Shimoda S, Sato H, Naga N, Nakano T, *Angew Chem Int Ed.* 2023, e202305747.

[2] Wang Q, Son K, Pietropaolo A, Fortino M, Ogasawara M, Ohji T, Shimoda S, Bando M, Nakano T. *Chem Eur J.* 2024, **30**, e202304275-e202304275.

[3] T. Nakano, M. Bando, A. Xing and N. Naga, *ChemistryEurope*, 2026, **4**, e202500449.

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