エネルギーランドスケープに基づく両親媒性ポリチオフェンミセルの精密合成

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Seeded Self-Assembly of Charge-Terminated Poly(3-hexylthiophene) Amphiphiles Based on the Energy Landscape ([1]*Laboratory for Chemistry and Life Science, Tokyo Institute of Technology*; [2]*Department of Chemistry, University of Victoria*) ○ Tomoya Fukui,[1] Ian Manners[2]

Control over self-assembly approaches to well-defined crystalline 1D nanostructures is a significant for applications in optoelectronics and biomedicine. We synthesized charge-terminated amphiphilic polythiophene homopolymers [**PT$_n$P**]**I** which self-assembled into colloidally stable fiber-like micelles in solution. In-depth studies of the self-assembly behavior permitted the unveiling of the energy landscape of the self-assembly process. On the basis of the kinetic and thermodynamic insight provided, we have been able to achieve an unprecedented level of control over the length of fiber-like micelles from 40 to 2800 nm[1]. Furthermore, the fiber-like micelles exhibited an exceptionally high exciton diffusion constant which is 1000 times higher than that of conventional polythiophene homopolymers[2].
Keywords : Polythiophene; Self-assembly; Living crystallization-driven self-assembly; Crystalline micelles; Energy landscape

分子・高分子の自己集合過程を制御し、ナノ構造体を精密に構築することは、優れた光電子的機能の発現のために必要不可欠である。本研究では、ポリマー末端にカチオン部位を導入した両親媒性ポリチオフェン [**PT$_n$P**]**I** を新たに合成し、溶液中においてファイバー状ミセルを形成することを明らかにした。さらに、ミセル形成過程のエネルギーランドスケープを明らかにし、その理解に基づき自己集合過程を速度論的に制御することで、ミセルの長さを 2800 nm まで制御することに成功した[1]。この結晶性ミセルを用いて作製したフィルムは、一般的なポリチオフェンの約 1000 倍となる巨大な励起子拡散係数を示すことを明らかにした[2]。

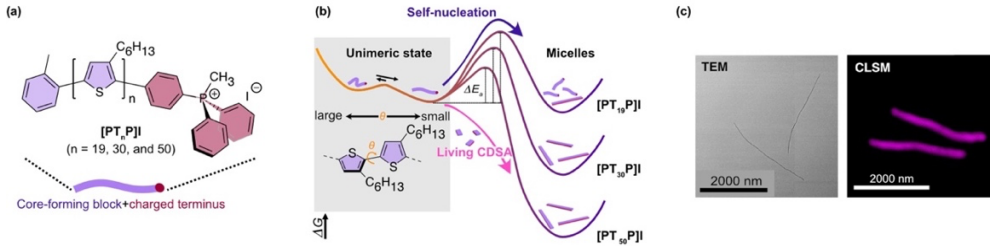

Figure (**a**) Structure of [**PT$_n$P**]**I** (**b**) Schematic representation of the energy landscape on self-assembly of [**PT$_n$P**]**I** in solution (**c**) TEM and confocal laser scanning microscopy images of fiber-like micelles.

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