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研究課題名(和文) 共役系高分子一本鎖のコンフォメーション制御による光電子物性の能動的制御

研究課題名(英文) Active control of opto-electronic properties of single conjugated polymer chains by control of their conformation

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研究成果の概要(和文)：高分子のナノ科学において、共役系高分子鎖のコンフォメーションと光学的、電気的物性との相関は応用化に向けて重要な課題である。本研究では、共役系高分子一本鎖のコンフォメーションを能動的かつ精密に制御し、分光特性及び光電的機能を明らかにすることを目的とする。コンフォメーションの制御手法として、化学的な構造によるトポロジー、相分離ブロック共重合体が形成する一次元ナノシリンダー構造、またはマトリックスの極性を用いた。このような条件下での単一共役系高分子鎖が発する蛍光や電界発光を測定し、解析により会合状態、電荷移動状態などの光物理的特性、または電界発光ダイナミクスなどの光電的特性を研究した。

研究成果の学術的意義や社会的意義

本研究の主な学術的意義として、共役系高分子ポリフルオレンの緑色発光帯、いわゆるg-bandの原因の解明が挙げられる。ポリフルオレンを用いた有機ELデバイスの色純度や効率の低下を起すg-bandは今まで多く研究され、原因としてはポリフルオレンの酸化が主に挙げられてきた。本研究では、ポリフルオレンの酸化がg-bandの出現に与える影響は小さく、電荷移動凝集体およびH-会合体の2種類の会合状態がg-bandの原因になっていることを明らかにした。この結果は高分子のナノ科学の発展、または共役系高分子を用いた光電デバイスの開発に大きく影響することが期待できる。

研究成果の概要(英文)：In the field of polymer nanoscience, the relationship between conformation of a conjugated polymer chain and its optical and electrical properties is an important problem both fundamentally and in view of potential applications. Here, we attempted to actively and precisely control the conformation of a single conjugated polymer chain and study its spectroscopic properties and opto-electronic functionality in relation to its conformation. The conformation was controlled by the polymer chain topology resulting from its chemical composition, by incorporation of individual chains into cylinders of phase-separated block copolymers, and by polarity of the surrounding matrix. Using such conformation control, we measured single conjugated polymer chains fluorescence and electroluminescence, and analyzed their photophysical properties in terms of molecular aggregate and charge transfer states, as well as their opto-electronic properties in terms of electroluminescence dynamics.

研究分野：有機材料ナノスケール特性

キーワード：1分子科学 共役系高分子





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<http://www.op.titech.ac.jp/lab/vacha/index.html>

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