常温液状π共役分子・高分子の光機能制御

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Regulation of Optical Characteristics of Room-temperature Liquid π-Conjugated Molecules and Polymers ([1]*Research Center for Materials Nanoarchitectonics (MANA), National Institute for Materials Science (NIMS)*, [2]*Graduate School of Life Science, Hokkaido University*)
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Due to the high entropy and steric hindrance effects inherent in flexible yet bulky branched alkyl chains, π-conjugated molecules and π-conjugated polymers arranged at the center of the molecule can be obtained as liquids at room temperature. A distinctive feature of alkyl–π liquid materials is that the optical and electronic functions derived from the π-conjugated moieties isolated within the molecule can be utilized as they are in the bulk liquid. Alkyl–π molecular liquids exhibit a so-called “solvent function” that allows other π-conjugated molecules to be dissolved in the liquid as solutes, making it possible to control the emission color via FRET from an electron-donor solvent to an electron-acceptor solute. On the other hand, focusing on the compatibility between π-conjugated polymer liquids makes it possible to reversibly control the cycle of miscibility by mechanical mixing (miscible) and thermal phase separation (immiscible). By controlling the miscibility, they exhibited unique mechanically induced luminescence properties, in which the emission color changes depending on the difference in FRET efficiency. The presentation will also introduce the compatibility between alkyl–π molecular liquids and the control of emission color.
Keywords : Alkyl-π Liquids; Conjugated Polymers; Luminescent Color Tuning; Dynamic Miscibility; Mechanically Induced Fluorescence Color Changes

柔軟で嵩高い分岐アルキル鎖に特有な高エントロピーと立体障害の効果により、分子中心に配置したπ共役分子やπ共役高分子は、常温液体として得ることができる[1)]。分子内で孤立状態となるπ共役部位由来の光・電子機能がバルク液体においてもそのまま活用できる点がアルキルーπ液体材料の特徴となる。アルキルπ分子液体の場合、他のπ共役分子を溶質として液体に溶解させることが可能な所謂「溶媒機能」を示すため、電子ドナー性の溶媒から電子アクセプター性の溶質へのFRETを介した発光色の制御が可能となる[2)]。一方、2種類の液状π共役高分子間の相溶性に着目すると、機械的に混ぜることで相溶し、熱的に相分離（非相溶）するサイクルで可逆に制御可能である。本系は相溶性の制御と同時に発光色もFRETの効率の違いに応じて変化する極めて特異的な機械刺激発光特性を示す[3)]。講演では、アルキルーπ分子液体間の相溶性と発光色制御に関しても紹介する。

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2) S. S. Babu, T. Nakanishi, et al., *Nat. Commun.* **2013**, *4*, 1969.
3) A. Shinohara, T. Nakanishi, et al., *Angew. Chem. Int. Ed.* **2019**, *58*, 9581–9585.