分子形状の異なるジチアルビセン誘導体の合成と物性および薄膜トランジスタ特性

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Synthesis, Physical Properties, and Device Characteristics of Dithiarubicene Derivatives with Geometrically Different Molecular Shape ([1]*Graduate School of Engineering, Nagoya Institute of Technology,* [2]*The Institute of Scientific and Industrial Research (ISIR), Osaka University*)
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Organic semiconducting materials have been attracting much attention in the past decades due to their mechanical flexibility and simple manufacturing method. The device performances are greatly influenced not only by the electrical properties of constituent molecule but also by the orientation of molecules on the substrate. Especially for organic field transistors (OFETs), when the molecules adopt the edge-on orientation (π-conjugated plane is perpendicular to the substrate), the charge transport path can be effectively formed between source and drain electrodes making it easy to obtain the superior device performance. However, there are many factors that affect the molecular orientation and the programed arrangement of molecules is still a challenging topic. Herein, we have focused on the shape of the molecule and tried to control the molecular orientation for the better OFET performance. We have synthesized a quasi-3D molecule having the “tripod-like structure” as well as related molecules having the different geometry with the parent molecule. Physical properties and device characteristics of them were systematically clarified from the viewpoint of molecular shape and the validity of “tripod-like quasi-3D structure” was confirmed.
Keywords : π-Conjugated Molecule; Electron-accepting Unit; Star-shape Molecule; Organic Semiconductor

有機半導体は、高い機械的柔軟性や簡便な製造方法から近年注目を集めている材料である。半導体性能は、構成する分子の電気的性質のみならず、基板に対する分子の配向様式にも大きく影響を受ける。特に、有機電界効果トランジスタ(OFET)では、分子が Edge-on(基板に対して π 共役平面が垂直方向)配向すると、電荷輸送パスがソース・ドレイン間の電荷輸送方向と一致するため、高いデバイス特性を得やすい。一方で、分子配向に影響を及ぼす要素は現在知られているものでも複数あり、その自在制御は未だ困難である。そこで我々は今回、分子の立体的な形状に注目し、分子配向の制御が可能であるか検討した。具体的には、”準三脚構造”とみなせる分子を合成した。また、その部分構造も合成することで、分子形状の観点から、それらの諸物性およびデバイス特性を系統的に明らかとし、本構造の有効性を検証した。

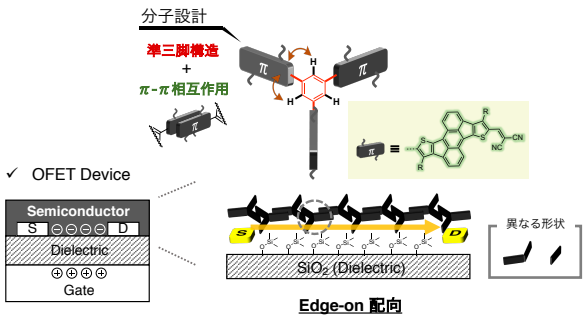

Figure. 本分子と基板に対する配向