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Alkyl substitution effect on thieno[3,2-b]thiophene derivatives exhibiting liquid-crystalline phases for organic field-effect transistor application

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The development of organic semiconductors achieving both solution-processability and macroscopically homogeneity has been essential and still highly challenging for the solution-processed organic field-effect transistors (OFETs) in printed electronics. Obtaining liquid-crystalline (LC) phases from organic semiconductors can be led to solution-processablity and self-organization into large area domains with a crystal-like structure and low defect.[1] Thus, they are promising candidates for the low-cost and high performance organic field-effect transistors. We synthesized novel semiconducting liquid crystals bearing an extended π-conjugated mesogen based on thieno[3,2-b]thiophene, which exhibit high solubility and low phase transition temperature. Especially, lateral substitution of methylene functional group to the mesogenic unit led to formation of efficiently self-organized LC domains at lower temperature than that of reported liquid crystalline thieno[3,2-b]thiophene derivatives.[2] Smectic A and smectic E phases were observed by a polarizing optical microscope over the wide temperature range between 75 and 125 ^{o}C. The hole mobility was determined by the time-of-flight (TOF) method, and calculated up to 2×10^{-3} $cm^2 V^{-1} s^{-1}$. In this presentation, we report the synthesis, thermophysical and carrier transport properties of novel liquid-crystalline semiconductors.

Reference

1) M. Funahashi, Polym. J. 41 (2009) 459.

2) W. Tang, et. al. J. Mater. Chem. 20 (2010) 1497.