Synthesis and Characterization of highly-ordered smectic benzothienobenzothiophenes and their OFET applications

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Recently, 2,7-disubstituted-[1]benzothieno[3,2-b][1]benzothiophenes have been attracted as organic-FET (OFET) materials for printed electronics, because of their high charge carrier transport properties and high stability in the air, in addition to feasibility of solution-processing. Especially, 7-decyl-2-phenyl-[1]benzothieno[3,2-b][1]benzothiophene (Ph-BTBT-C10) shows a highly-ordered smectic mesophase of SmE and its polycrystalline thin films fabricated from the SmE phase gives very high FET mobility over 10 cm²V⁻¹s⁻¹.[3] In order to understand and improve its unique and superior properties as an OFET material, some Ph-BTBT-alkyl derivatives (Ph-BTBT-Cn (n:6-14)) were synthesized and investigated their liquid-crystalline behaviors and charge-transporting properties as OFETs.

Ph-BTBT-C10: Liquid crystalline phase behavior and the polarizing microscope photo of SmE phase

The target compounds are unsymmetrically substituted BTBT derivatives. In conventional synthetic routes the syntheses of these compounds are very complicated, so that more convenient synthetic route was developed. Thus, selective mono-bromination of BTBT by bromine followed by Suzuki-coupling reaction with phenylboronic acid gave Ph-BTBT in good yield. Next, Ph-BTBT was acylated by alkylacyl chlorides catalyzed by aluminum chloride, and then acylated products were reduced by borane derivatives to afford the target Ph-BTBT-Cn’s in good to high yields.

New convenient syntheses of Ph-BTBT-Cn

The liquid-crystalline behaviors and OFET performance of these compounds will be also discussed.

References:

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