Synthesis, Properties, and Application of Novel Spiro-condensed Dithienogermoles

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INTRODUCTION

Spiro-linked compounds show a high morphologic stability, facile processability and high luminescence quantum efficiencies. These compounds consist of two equal molecular halves connected by a common sp^3 atom (spiro center). The two halves of the molecule are orthogonally arranged. This stereo structure enhance the rigidity of the core and prevents crystalline packing and intermolecular interaction between chromophores in the solid state[1],[2].

RESULTS AND DISCUSSION

Spiro-condensed dithienogermole use germanium as heteroatom bridge, at the 3,3´-position of bithiophene. Due to interaction between σ* orbital of the Ge-C σ bonds and π* orbital of the bithiophene unit (σ*-π* conjugation) the LUMO energy level is lowered [3]. As example, Figure 1 shows the reaction of 3,3´-Dibromo-5,5´-bis(trimethylsily)-2,2´-bithiophene with germanium tetrachloride affording the corresponding spiro-(dithienogermole) (1). The bromination of compound (1) with gave (2) as yellow solid with a yield 50%. (2) was subjected to a Suzuki coupling reaction with phenylboronic acid to give compound (3) as orange-yellow crystals with a yield of 51%. The absorption maxima of compound (3) are at 273 nm, 409 nm and the emission maximum at 489 nm showing a large Stokes shift in the order of 80 nm. The cyclic voltammograms (CV) show that compound (3) exhibits two reversible one-electron oxidation processes and a quasi-reversible one-electron reduction processes. The HOMO-LUMO-gap is 2.93 eV. Applications in organic optoelectronics as charge transport and emitter material are feasible.

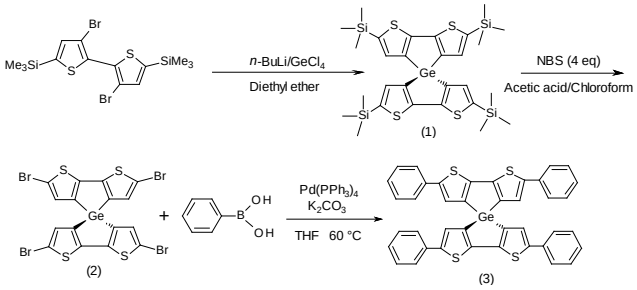

Figure 1. Synthetic route to 2,2´,6,6´-Tetraphenyl-4,4´-spirobi[dithienogermol] (4)

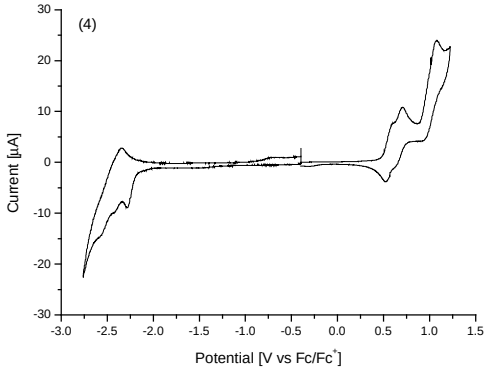

Figure 2. cyclic voltammogram of (4) measured in THF(oxidation) and dichloromethane (reduction)

CONCLUSION

We prepared new spiro-condensed dithienogermole compounds and discuss on the structural properties, absorption fluorescence spectroscopic data and electrochemical properties for organic electronic applications.

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