SYNTHESIS and CHARACTERIZATION of THIENOTHIOPHENE and BORON CONTAINING MOLECULES FOR OLED APPLICATIONS

R. Isci, P. Ulukan, , T. Ozturk*

ABSTRACT

Two D-A type molecules were synthesized which contain mesityborane units as acceptors , TPA units as donors and thieno[3,2-b]thiophene units as π bridges were synthesized. Electrochemical and photo properties were investigated with both experimentally and computational studies.

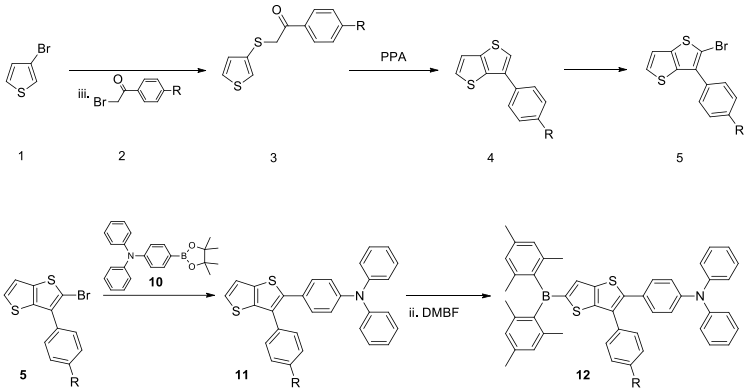
INTRODUCTION

Organic light emitting diodes (OLEDs) are an important innovation in display technology. This technology provides improved image quality, high brightness, low power consumption and high durability [1]. Also, with their ultra-thin structure and low production costs, OLEDs promise great developments in display market. Their operation is based on the phenomenon called electroluminescence, which is the conversion of electrical energy into light [3].

In the last few years, with the recent developments in technology, the applications of organic molecules in OLEDs, biosensors, capacitors, electrochromic devices and organic photovoltaics became very important. Different functional groups on molecules provide different absorption, emission or capacitor characteristics and determine their usage areas.

Thienothiophene (TT) molecules with long π conjugation and planar structures have many applications in material chemistry. Because of the nonbonding electrons on sulfur atom of thiophene ring, TT structures are in donor characteristic. Thus, they can be used in conjugate systems. In this study, we aimed to synthesize and investigate the optical properties of D−π-bridge−A systems as promising OLED materials. For this purpose, molecules **11a** and **11b** were synthesized. Then, the structures **12a** and **12b**, possessing mesitylborane units as acceptors (A) and triphenylamine (TPA) groups as donors (D), have been synthesized and demonstrated extremely high quantum yields. The characterization of these molecules showed us that they both are promising OLED structures.

EXPERIMENTAL

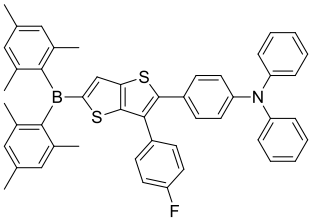


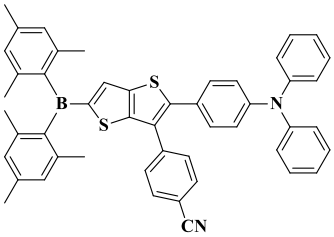
R= F for **a**
R= CN for **b**

[a] Department of Chemistry, Faculty of Science, Istanbul Technical University,

Maslak, Istanbul 34469, Turkey. E-mail: ozturktur@itu.edu.tr

RESULTS and DISCUSSION





Emissions of molecules **12a** and **12b** under UV light and quantum yield values are very good, thus making them appropriate OLED molecules . In the UV-Vis spectra of molecules it is observed that the peak tails reach upto 450 nm in liquid state and approximately 500 nm in solid state. Also cyclic voltammetry measurements of molecules have been studied and the electrocehmical band gaps were calculated by using oxidation and reduction potentials. In these measurements, a Pt wire was used as working and counter electrodes. As a reference electrode a Ag wire was used. A 0.1 M $TBAPF_6$ and 10^{-3} M monomer consisting of ACN/DCM solvent mixture were prepared as the electrolyte. In cyclic voltammograms, it is noticed that there are two oxidation potentials. According to the literature, the first one belongs to TPA molecule.

REFERENCES

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