PHENOXAZINES HAVING VARIOUS ELECTRON ACCEPTOR FRAGMENTS AS NEW HOST MATERIALS FOR GREEN PHOSPHORESCENT OLEDS

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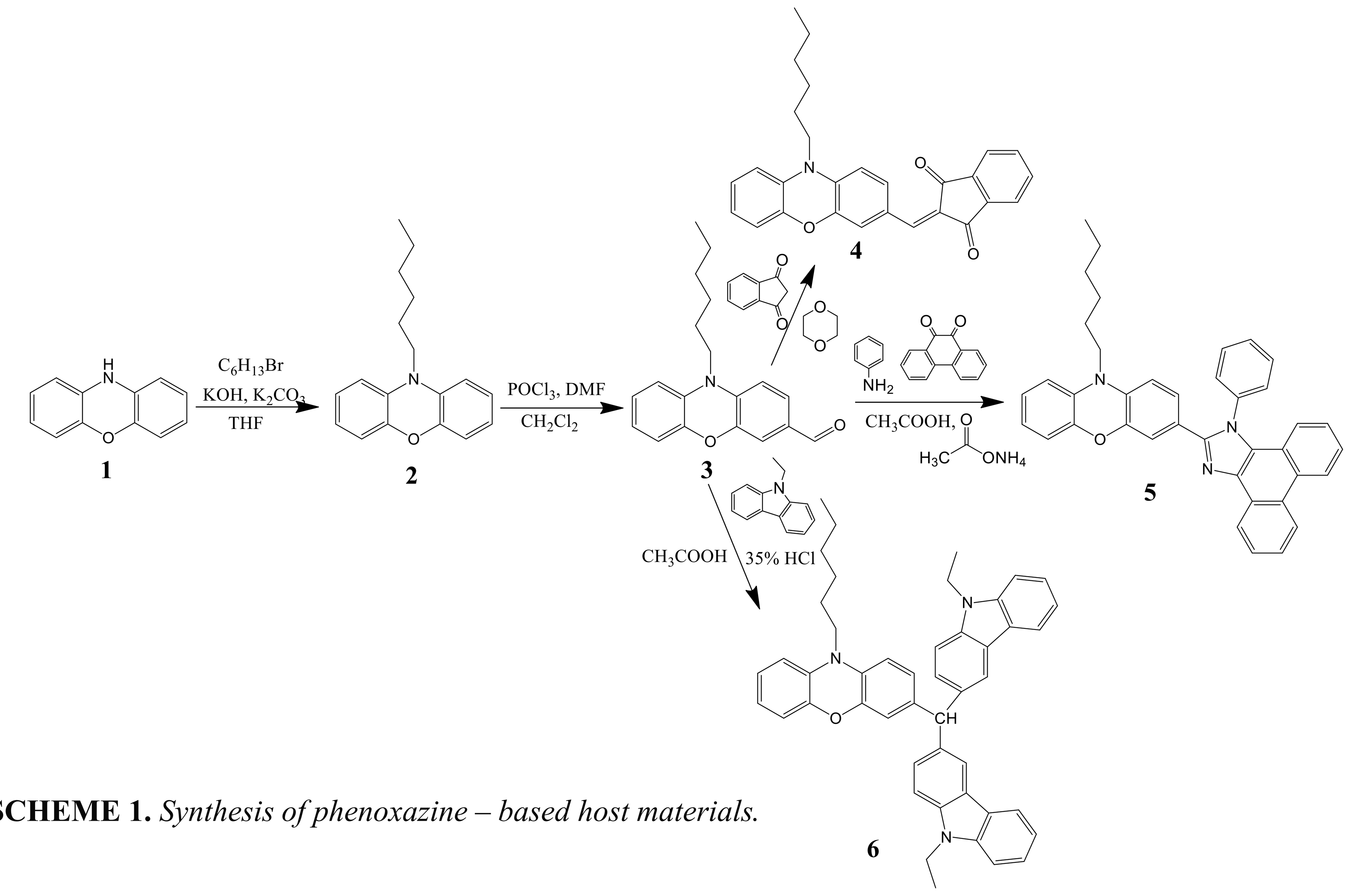
Introduction

We report on the synthesis and characterization of a new series of bipolar phenoxazine-based compounds. The derivatives are thermally stable materials as it was demonstrated by thermogravimetric analysis. Electron photoemission spectra of thin layers of the materials show ionization potentials in the range of 5.24-5.56 eV. Some of the developed materials form homogenous amorphous layers with high glass transition temperatures and were used as hosts for bis[2-(2-pyridinyl-N)phenyl-C](acetylacetonato)iridium(III), $Ir(ppy)_2(acac)$, guest in green phosphorescent organic light-emitting diodes. Results indicated that a device with 3-[bis(9-ethylcarbazol-3-yl)methyl)-10-hexylphenoxazine host exhibited superior performance with maximum current efficiency of 18.3 cd/A, maximum brightness of 5366 cd/m² and low turn on voltage of 3.1 V.

Synthesis



SCHEME 1. *Synthesis of phenoxazine – based host materials.*

Ionization potentials of layers of the compounds

Compound	I_p
4	5,24 eV
5	5,56 eV
6	5,27 eV

TABLE 1. Ionization potentials of layers of the compounds **4-6**

The established I_p values were evident that thin layers of the materials are relevant for hole injection from PEDOT:PSS injecting layer; however derivatives **1** and **3** have more suitable I_p as a hole transporting host materials.

Thermal properties

Material	T_g, °C	T_m, °C	T_d, °C
4	-	199	324
5	75	167	389
6	93	-	387

TABLE 2. Thermal characteristics of materials **4-6**

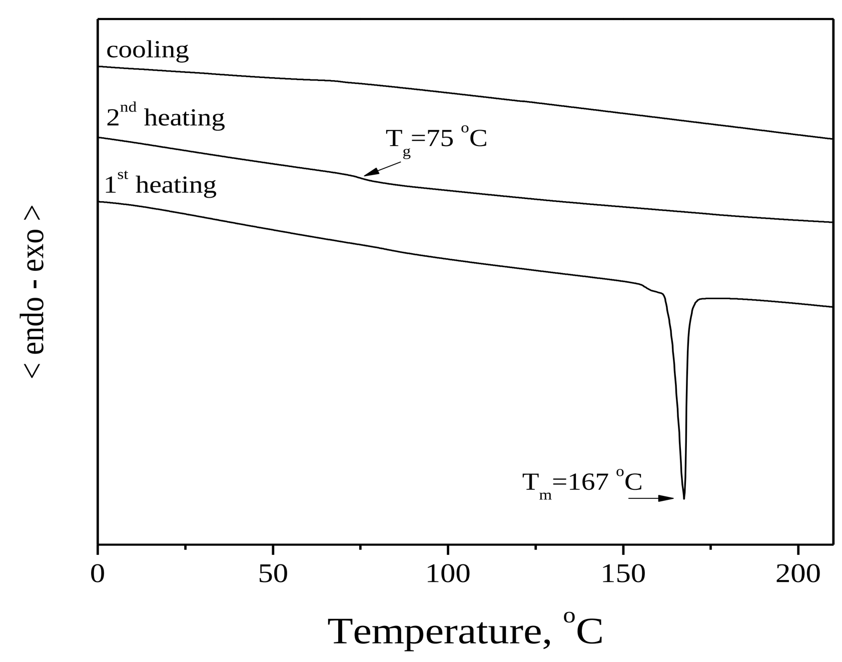


FIGURE 1. *DSC curve of material* **5.**

Electron photoemission spectra

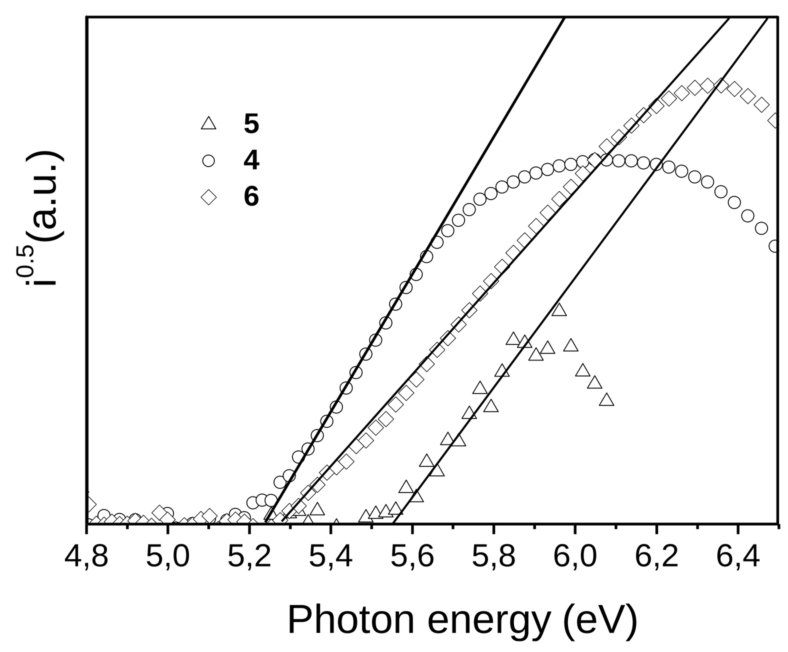


FIGURE 2. Electron photoemission spectra of the layers prepared using materials **4-6.**

OLED characterisation

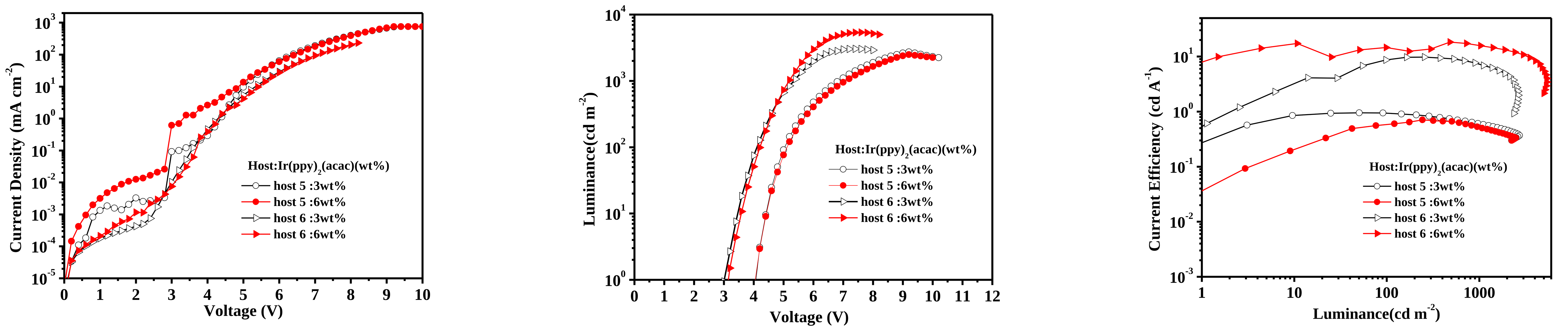


FIGURE 4. *OLED characteristics of the devices using green triplet emitter $Ir(ppy)_2(acac)$ doped in host materials* **5** *and* **6**.

Conclusion

In conclusion, new bipolar electro-active materials were synthesised using phenoxazine as electron donor fragment connected with various electron acceptors. Some of the materials formed homogeneous solid amorphous films with glass transition temperatures of 75 -93 °C. Layers of the synthesized compounds showed ionization potentials of 5.24-5.56 eV. The compounds, which formed homogenous amorphous layers, were tested as host materials for green phosphorescent OLEDs by using green triplet emitter of bis[2-(2-pyridinyl-N)phenyl-C](acetylacetonato) iridium(III), $Ir(ppy)_2(acac)$ as the guests. The device with the host of 3-[bis(9-ethylcarbazol-3-yl)methyl)-10-hexylphenoxazine exhibited the best overall performance. The efficient green OLED using the host demonstrated low turn-on voltage of 3.1 V, a maximum brightness of 5366 cd/m², and maximum current efficiency of 18.3 cd/A. For the technically important brightness of 1000 cd/m² an efficiency above 15.7 cd/A was detected in the device.

Acknowledgement

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