



New high molecular weight aromatic polymers for PhOLED applications made by Friedel-Crafts-type polymerization

Nils Fröhlich¹, Frank Galbrecht¹, Christof J. Kudla¹, Carmen Gutierrez Hernandez², Mikhail Zolotukhin², Nina Rehm³, Klaus Meerholz³, Simon King⁴, Andy Monkman⁴ and Ullrich Scherf¹

¹ Macromolecular Chemistry and Institute for Polymer Technology, Bergische Universität Wuppertal, Gauss-Str. 20, D-42097 Wuppertal, Germany

² Instituto de Investigación en Materiales, Universidad Nacional Autónoma de México, Circuito Exterior, Cd. Universitaria 70-360, Coyoacán, C.P. 04510, México

³ Institute for Physical Chemistry, Universität zu Köln, Luxemburger Str. 116, D-50939 Köln, Germany

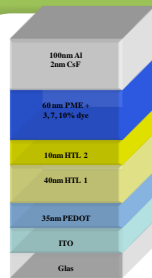
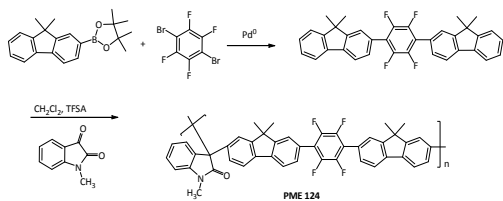
⁴ Department of Physics, Durham University, South Road, Durham, DH1 3LE, UK

Introduction

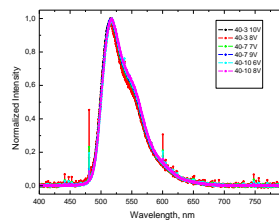
Aromatic polymers with a rather high triplet energy are of importance as matrix materials for phosphorescent dopants in phosphorescence-based organic light emitting diodes (PhOLEDs).

We present the synthesis of a high molecular weight fully aromatic polymer in a poly-Friedel-Crafts reaction in superacidic medium starting from N-methylisatine and 1,4-bis(9,9-dimethylfluorene-2-yl)-2,3,5,6-tetrafluorobenzene. Aromatic monomers for structurally related polymers have also been prepared.

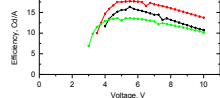
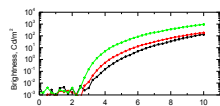
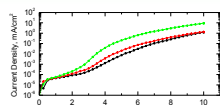
Synthesis



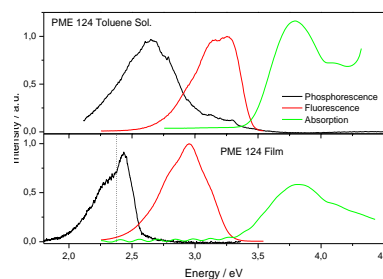
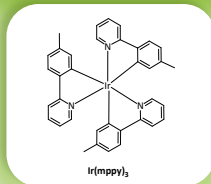
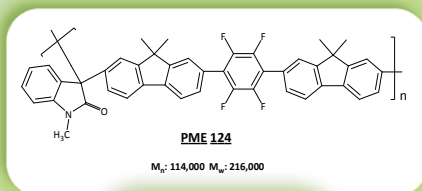
Configuration of the investigated PhOLED devices



EL spectra of the investigated PhOLED devices at different voltages (6-10 V) and dye loading (3, 7, 10 %)

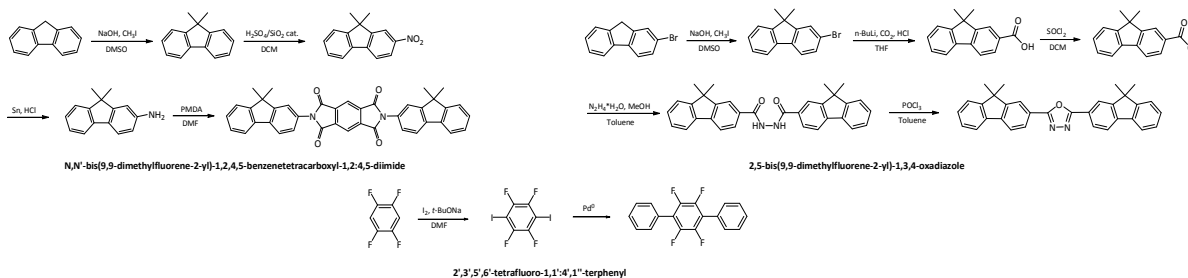


Luminance/ Current density/ Voltage (LIV) plots of three PhOLEDs with 3 (black), 7 (red), and 10 % (green) Ir(mppy)₃ in PME 124



Optical spectra of PME 124 in toluene solution and in the solid state; the dotted line in the solid state phosphorescence spectrum indicates the lower lying triplet energy level of the dopant Ir(mppy)₃

New aromatic monomers for future polymer synthesis



Conclusion

- High molecular weight aromatic polymers have been prepared in a Friedel-Crafts-type polycondensation of unsubstituted bisaryl monomers and N-methylisatine in superacidic medium.^{1,2}
- PME 124 with a 1,4-bis(9,9-dimethylfluorene-2-yl)-2,3,5,6-tetrafluorobenzene chromophoric unit has been successfully used as matrix polymer of phosphorescent OLEDs (PhOLEDs) in combination with Ir(mppy)₃ as phosphorescent dopant, the maximum PhOLED efficiency was ca. 17.5 Cd/A for a dopant level of 7%.
- A series of novel aromatic monomers for future polymer synthesis have been prepared.

References

[1] Howard M. Colquhoun, Mikhail G. Zolotukhin, Leonard M. Khalilov, and Usein M. Dzhemilev, *Macromolecules*, **2001**, 34 (4), 1122.

[2] Mikhail G. Zolotukhin, Serguei Fomine, Luz Maria Lazo, MA. Del Carmen G. Hernández, M.T. Guzmán-Gutiérrez, Alberto Ruiz-Trevino, Detlev Fritsch, David Cuellas and Juan M. Fernandez-G., *High Performance Polymers* **2007**, 19, 638