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1, 2, 3 *Polymers as basic for a new electronic.*
4 *Synthesis.*

POLYMERS AND ELECTRONICS

Polymers can possess electrically conducting, semiconducting or isolating properties as a function of the chemical structure. The isolation ability of the polymers is used already since beginning of the 20th century in electro technology. Electrically active polymers were manufactured for the first time and characterized only since the mid seventies. The term polymer electronics was shaped for the application of these new materials for electronics. Such electronically applications are for example displays, OLEDs, OTFTs, RFID-tags, solarcells, sensors and actuators.

The advantage over the conventional Si based electronics lies in the fact that devices could be realized for large area, mechanically flexible and very cheap electronic components. Therefore inexpensive printing processes, roll-to-roll coating and structuring methods form an important basis for future products within this range. We concern ourselves with the development of new organic materials for the application in polymer electronics and adapt these to the development of solution based processing like printing technologies. Beside that we develop new dielectric elastomers with high permittivity as electro-active actuator materials for artificial muscles. New polymer structures are currently studied as solid state electrolytes for battery systems with improved properties.

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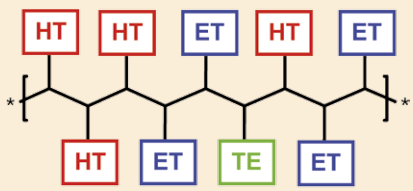
pioneers in polymers

Material development for OLED

Development and design of conjugated and non conjugated phosphorescent polymer materials

Polymers exhibit the ability to integrate all the active components like the hole-, electron-transport and phosphorescent molecules in only one or three layers. In one case, structure optimized and energy-level adapted hole-, electron-transport and phosphorescent molecules were selected and modified with polymerizable groups. Terpolymers were synthesized containing optimized ratio of the three selected components. Another approach is to separate the transport molecules in two different layers. For this reason cross linkable polymers have been developed realize the multilayer deposition during wet processing.



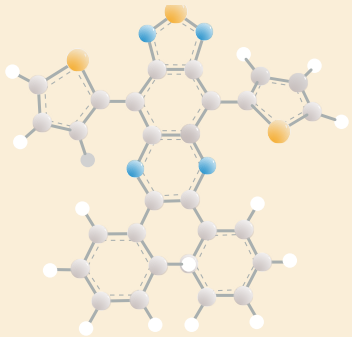
Section of phosphorescent polymer backbone.

Material development for OTFTs

Synthesis and design of semiconducting conjugated organic materials (p and n-type) are performed processable from solution and with improved air stability properties. Adapted organic dielectrics are developed for the organic semiconductors. In case of thin organic dielectrics (500 – 20 nm) crosslinkable polymer systems are realized.

Material development for OPV

The two goals of OPV-materials are tailoring of low bandgap polymers and polymers with defined electronaffinity. Organosoluble semiconducting, conjugated polymers are designed with well adapted HOMO- and LUMO-energy levels by introduction of donor-acceptor units with different acceptor strength. The introduction of acceptor units like chinoxaline or oxadiazole in the polymer backbone leads to polymers with high electronaffinity which are suitable for the replacement of BCBM in solar cells.



Donor-acceptor-unit.

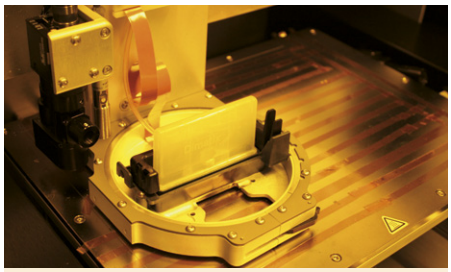
Material testing in different device structures

The new synthesized polymers are tested in devices to investigate the performance of the new materials and to get a fast response for further developments. Devices can be realized on rigid and flexible structures and also in different architectures. Bottom gate and also top gate components are set up in case of OTFTs for example.

Formulation development

All the synthesized organosoluble polymers are formulated as inks for large area processing more specifically, inkjet, screen or gravure printing techniques.

Therefore, different solvents and mixtures of solvents are tested and the viscosity of the printing formulation can be adjusted to the printing process. Formulations are optimized for inkjet printing using a Dimatix inkjet printer.



Printhead of an inkjet printer.

Main focus on the work

- synthesis of functionalized organic monomers
- performing and optimization of polymerization reactions like metal catalyzed coupling reactions
- development of purification processes for application of the polymers in electronic devices
- investigations of electrical and optical properties in relation to chemical structures