Abstract

The work is concerned with the synthesis and properties of novel conjugated donor-acceptor copolymers containing different diketopyrrolopyrrole (DPP) chromophors in the main chain. Upon introduction of different donor substituents, it is possible to vary the structure of DPP-based polymers and to optimize the properties of the polymers, so that they are well suited as active materials in optoelectronic applications.

Chapter I of the work (Kap 4.1) deals with the synthesis of tetraarylated regioisomeric diketopyrrolo[3,2-*b*]pyrrole (isoDPP) based monomers and polymers. The polymers were prepared by palladium-catalyzed Suzuki and Sonogashira coupling or Yamamoto coupling, the molecular weights being between 2 and 23 kg/mol. The polymers show broad absorption bands with maxima around 420 nm. The band gaps are between 1.29 and 1.89 eV. Upon anodic oxidation the polymers exhibit reversible colour changes from dark red to blue. Furthermore, isoDPP polymers with additional thiophene groups in the main chain were prepared upon anodic electropolymerization. They show a bathochromic shift of the absorbance compared to the polymers prepared upon cross-coupling reactions. They also show electrochromic properties. The isoDPP-based polymers are potential materials for photovoltaic or electrochromic devices.

In **Chapter II** (Kap. 4.2) the synthesis and characterization of an asymmetric diketo-pyrrolo[3,4-*b*]pyrrole (asDPP) based monomer is described. In comparison to DPP- and isoDPP-based monomers, the asymmetric structure of asDPP leads to a bathochromic shift of absorbance with a maximum at 554 nm in DMF solution.

Chapter III (Kap. 4.3) is concerned with conjugated polymers containing dithioketo-pyrrolo[3,4-*c*]pyrrole (DTPP) and dithioketopyrrolo[3,2-*b*]pyrrole (isoDTPP) units in the main chain. The synthesis route is based on a chemical modification of previously prepared DPP-containing polymers with Lawesson´s reagent (LR). Upon thionation a strong bathochromic shift of the absorption maxima up to 100 nm takes place. A study of the photostability indicated that the dithienyl-DTPP-polymers were fairly stable against UV- or visible light irradiation, while diphenyl-DTPP polymers were rapidly bleached.