All-Conjugated Diblock Copolyelectrolytes

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Inspired by the unique properties of conjugated polyelectrolytes and rod-rod block copolymers, a combination of both classes of materials seems very promising thus leading to all-conjugated block copolyelectrolytes composed of one ionic polyelectrolyte block and one non-polar block. Such advanced materials based on electronically different conjugated polymer backbones and different pendant groups (including ionic side groups) have been synthesized within this thesis followed by studying their optical and self-assembly properties as well as their complexation behavior with biomolecules and their incorporation into optoelectronic devices. For example, the application of the polyfluorene-*b*-polythiophene diblock copolymers as thin electron extraction layers of bulk-heterojunction-type organic solar cells leads to an increase of the power conversion efficiency from ca. 5.3 to ca. 6.5%.[1]

The synthesis of cationic polyfluorene-*b*-polythiophene diblock copolymers with varying ionic groups is described. The optical properties have been investigated dependent on the aggregation state and their application as electron extraction layer of organic solar cells. In addition, the interaction of these all-conjugated block copolyelectrolytes with oppositely charged molecules (e.g. biomolecules, anionic surfactants, organic acids) is reported. Also, novel diblock copolymers containing both a neutral and a charged (ionic) poly(alkylfluorene) block are introduced. UV-Vis absorption and photoluminescence of the diblock copolymer have been analyzed as well as their self-assembling behavior and an incorporation as thin electron injection/transport layers of organic light emitting diodes (OLEDs). Such conjugated polyelectrolytes are promising candidates for improving the electron injection into the organic layers of OLEDs.

[1] J. H. Seo, A. Gutacker, Y. Sun, H. Wu, F. Huang, Y. Cao, U. Scherf, A. J. Heeger, G. C. Bazan, *J. Am. Chem. Soc.* **2011**, *133*, 8416.