Synthesis and photovoltaic properties of novel (X-DADAD)$_n$ conjugated polymers with fluorene and phenylene blocks

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Conjugated polymers are promising semiconductor materials for organic photovoltaic devices based on p-n junction. Organic solar cells (OSCs)[1], organic light-emitting diodes [2], organic photodetectors [3] etc. attracted considerable attention in recent years due to their important advantages over inorganic analogues such as flexibility, lightweight, stretchability and semitransparency. Furthermore, organic photovoltaic devices can be fabricated over large areas using low-cost and high throughput printing technologies [4]. Here we report the synthesis and investigation of novel fluorene- and phenylene-based conjugated polymers with TBTBT molecular framework consisting of thiophene (T) and benzothiadiazole (B) building blocks. It has been demonstrated that variation of X building blocks with branched side chains in (X-TBTBT)$_n$-type structures as well as introducing fluorine into main chain strongly affect the optical, electronic and physicochemical properties of resulted polymers. The investigation of photostability of polymer thin films in accelerated tests showed that fluorine-containing polymers are promising materials for organic solar cells with long-term operation stability. Phenylene-based polymer with fluorine-loaded TBTBT block provided power conversion efficiency of 7% in organic solar cells that can be further improved by optimization of morphology of active layer.

This work was supported by the Russian Foundation for Basic Research (project No. 20-03-00309) and Ministry of Science and Higher Education of the Russian Federation within the projects No. AAAA-A19-119101590029-0. We acknowledge the participation of Dr. P.M. Kuznetsov in the characterization of organic solar cells. The authors also gratefully thank Dr. Troshin P.A. for providing the equipment of FMEM laboratory at IPCP RAS.

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