New Perspective Materials for Organic Photovoltaics

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In this project, photovoltaic characteristics of two novel, low-band gap, semi-conducting derivatives of poly(2,7-carbazole) were studied. The first derivative (PCBTDPP) possesses the carbazole moiety linked do diketopyrrolopyrrole core, whereas in the second polymer (PCDTBT) is the carbazole connected to benzothiadiazole. Both organic semi-conducting materials were tested in organic photovoltaic cells (OPVC). In this respect, several prototypes of OPVC devices were prepared and their optical and electrical properties were studied. The emphasis has been put on the effects affecting photovoltaic solar conversion, mutual comparison of the results and further elucidation of the structure-property relationships. The PCBTDPP and PCDTBT materials were studied separately or mixed with electron acceptors such as two fullerene derivatives PC60BM and PC70BM. The prepared OPVC devices were studied by the UV-Vis absorption and luminescence spectroscopy and the conductivity (I V characteristics). The fill factor (FF) and the photovoltaic conversion efficiency were further evaluated from the obtained I-V characteristics. The UV-Vis absorption spectra showed that all materials absorb solar light in close-to-ideal wavelengths. The device PCBTDPP:PC70BM showed the highest FF (49 %) while the achieved photovoltaic efficiencies were close to 1 % with the highest value reaching 1.64 % for PCDTBT:PC60BM. These measured characteristics revealed that both novel organic semiconductors are well-suited for the organic photovoltaics and the prepared OPVC devices can be considered as the most efficient ones produced within the OPVC research in the Czech Republic

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