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Synthesis And Characterization Of Perfluoroalkylated Perylene Diimide Based N-type Polymers For Optoelectronic Applications

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Abstract

Organic semiconductors gain wide interest in academics and industry over past two decades due to their vital applications in flexible optoelectronic devices such as organic field effect transistors (OFETs) and organic photovoltaics (OPVs). Stability of the semiconducting materials under different environmental conditions (presence of oxygen, moisture) is important for photovoltaic devices. Although p-type organic semiconducting materials are well developed, their counterparts n-type organic semiconductors with optimum air stability and good operational performance are less developed. Perylene derivatives are well known n-type organic semiconductor materials used in variety of optoelectronic applications. Although perylene derivatives are good n-type semiconductor materials but the devices made of perylene diimides are lacking stability at operational ambient conditions. Therefore, the design and synthesis of air-stable perylene diimide based n-type materials is an urgent research endeavor in the field of optoelectronics. Here we report the synthesis, characterization and optoelectronic properties of perfluoroalkylated perylene diimide based n-type polymers such as Poly[9,9-dioctylfluorene-2,7-diyl-alt-N,N'-di(trifluo romethylphenyl)-3,4,9,10 perylene diimide-1,7-diyl]. These polymers showed three absorption peaks characteristic of perylene diimides. We observed significant red shift for thin films of polymers when compared to polymers in solutions. These polymers can have potential applications in flexible polymers solar cells as well as in OFETs as electron acceptor materials.