Low band gap polymers based on 1,4-dialkoxybenzene, thiophene, bithiophene donors and the benzothiadiazole acceptor

Four new copolymers of 1,4-dialkoxybenzene, thiophene, bithiophene and benzothiadiazole have been prepared and investigated for optical properties and in photovoltaic devices. The structures were chosen to show the effect of successively introducing an acceptor moiety, longer alkoxy side chains and finally, substituting thiophene for bithiophene. The absorption spectra and IPCE showed that these are low band gap polymers that can harvest light in the visible spectrum (400 to 700 nm) and that photoelectrons are generated in the whole range. The photovoltaic devices produced short circuit current densities ($J_{sc}$) of 2.6 to 4.6 mA/cm$^2$ under AM1.5 G illumination. The open circuit voltage ($V_{oc}$) was 0.56 to 0.64 V and the efficiencies ($\eta$) of 0.8\% to 2.2\% depending on the structure.

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