Dithienopyran-based donor-acceptor copolymers with enhanced thermal stability and charge carrier mobility

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We investigate the electrical and thermal properties of dithienopyran (DTP)-based copolymers prepared with various electron-deficient (as electron acceptor) or electron-rich (as electron donor) moieties. With electron-deficient units such as 2,1,3-benzothiadiazole (BT) and 5-fluoro-2,1,3-benzothiadiazole (FBT), DTP-based donor–acceptor (D–A) copolymers showed remarkably enhanced charge carrier mobility and thermal stability in the wider range of processing temperatures compared to those of donor–donor (D–D) copolymers prepared with electron-rich 2,2'-bithiophene (T2) and 1,2-di(thiophen-2-yl)ethane (TVT) units. Such enhanced charge carrier mobility and thermal stability of the D–A copolymers are attributed to the electronic structures and higher crystallinity retained in the wide range of processing temperatures (25 - 300 ℃) confirmed by the ultraviolet-visible absorption spectroscopy and two-dimensional grazing-incidence wide angle X-ray diffraction results, respectively. These results demonstrate that D–A configuration is a promising molecular framework for realization of thermally-stable OFET-based plastic electronics.