Side chain engineering in charge transport and optoelectronic properties of organic field-effect transistors

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Backbone engineering in organic transistors has become the prominent strategy to enhance their electrical performance. Herein, we report the effects of chalcogen atoms on organic transistors by appending different sizes of chalcogenophenes (furan, thiophene, and selenophene) to thiophene-flanked diazapentalene (DAP) polymer, where long alkyl chain is used as solubilizing group. The phototransistor with a device configuration of Si/SiO2/active layer/Au was fabricated using DAP polymer as active layer and exhibited optical properties in near-infrared (NIR) region. The electrochemical properties, charge transport characteristics, and microfilm analysis are discussed as a function of size of the chalcogenophenes. As the size of the heteroatom increases, dihedral angle of copolymer structure decreases, leading to minimization of steric hindrance and thus, better crystallinity. This study provides insight into structure-property behaviors in organic transistor characteristics.