Design of Orthogonal Polymer Semiconducting for Sequential Solution High-resolution Tandem Electronics

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Herein, we present a novel orthogonal polymer semiconductor (OPS) that is capable of showing chemical and physical endurance during sequential solution coating and photolithography processes. We adopted sol-gel process to achieve the orthogonality of organic semiconductor. The major step of a sol-gel reaction is hydrolysis and condensation reactions which can convert molecular precursors into a highly cross-linked network. As a result of manipulating this step carefully, we could achieve a self-assembled structure of either quasi-3D random or ladder characteristics. This structure enables the thin film to attain the highly tolerance against harsh external stimuli. Consequently, we showed that sub-micron pattern and formation of tandem structures of OPS can be done through conventional photolithography with sequential solution and RIE etching processes, and finally achieved tandem electronic devices including a pn-complimentary inverter logic circuit and pixelated polymer light-emitting diodes.