Precision Synthesis of Various Low-Bandgap Donor-Acceptor Alternating Conjugated Polymers via Living Suzuki-Miyaura Catalyst-Transfer Polymerization

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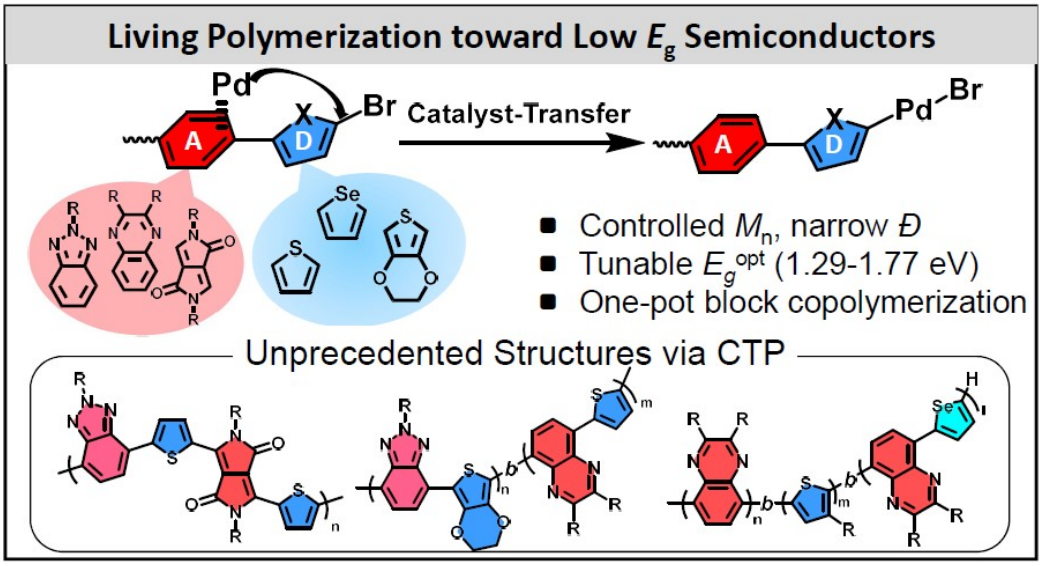
In this study, we present the living Suzuki-Miyaura catalyst-transfer polymerization (SCTP) using a RuPhos Pd G3 precatalyst as a versatile approach for the precision synthesis of several types of donor-acceptor alternating conjugated polymers (DA ACPs). Initially, we optimized the living SCTP process for biaryl monomers with varying electronic characters of both strong and medium electron-donating (D) and electron-accepting (A) groups. This optimization allowed us to obtain DA ACPs with controlled number-average molecular weight (M_n), narrow dispersity ($Đ$, 1.05-1.29), and high yields (>87%). Furthermore, we successfully expanded this method to the controlled polymerization (M_n = 9.2 - 40.0 kg mol^{-1}) of a quateraryl monomer (A_1-D-A_2-D) containing diketopyrrolopyrrole (DPP; a strong acceptor). Additionally, the living SCTP technique facilitated the efficient one-step synthesis of various diblock and triblock copolymers. Lastly, the resulting DA ACPs exhibited adjustable optical band gaps (E_g^{opt}) ranging from 1.29 to 1.77 eV and varied highest occupied molecular orbital (HOMO) levels (from -5.57 to -4.75 eV), while their block copolymers displayed wide absorption spectra and demonstrated promising light-harvesting properties in the visible range.



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