

Water/Ethanol-Soluble NDI-Based Conjugated Polymers for Eco-Friendly and Air-Stable All-Polymer Solar Cells

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Environmentally benign aqueous-processed all-polymer solar cells (aq-APSCs) are reported for the first time by developing a series of water/ethanol-soluble naphthalene diimide (NDI)-based polymers: P(NDIDEG-T), P(NDITEG-T), and P(NDITEG-T2). The polymers were designed by attaching hydrophilic oligoethylene glycol (OEG) side chains to facilitate processability in the polar solvents. The P(NDIDEG-T) polymer with shortest OEG side chains exhibited the highest performance with a power conversion efficiency (PCE) of 2.15%. Furthermore, these aq-APSCs showed outstanding air-stability as evident by maintaining more than 90% of the initial PCE in air after 4 days. The double cantilever beam tests revealed that the high interfacial adhesion properties between the OEG-based active layer and hydrophilic electron/hole transporting layers can be the origin of the enhanced durability under ambient conditions. Both the good device stability and eco-friendliness make the aq-APSCs worthy candidates for development of scalable PSCs.