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Solvent-Resistant Organic Transistors and Thermally-Stable Organic Photovoltaics Based on Crosslinkable Conjugated Polymers H.J. KIM, C.-H. CHO, B.J. KIM, KAIST, A.-R. HAN, J.H. OH, UNIST, J.M.J. FRECHET, UC Berkeley — Conjugated polymers in general are unstable when exposed to air, solvent, or thermal treatment, and these challenges limit their practical applications. Herein we have developed a simple, but powerful approach to achieve solvent-resistant and thermally stable organic electronic devices with improved air-stability, by introducing a crosslinkable group into a conjugated polymer. To demonstrate this concept, we have synthesized polythiophene with crosslinkable groups attached to the end of alkyl chain. Photo-crosslinking of crosslinkable P3HT dramatically improves the solvent resistance of the active layer without disrupting the molecular ordering and charge transport. This is the first demonstration of solvent-resistant organic transistors. Furthermore, the bulk-heterojunction organic photovoltaics (BHJ OPVs) containing crosslinkable P3HT show an average efficiency higher than 3.3% after 40 h annealing at an elevated temperature of 150°C, which represents one of the most thermally-stable OPV devices reported to date. This enhanced stability is due to an in-situ compatibilizer that forms at the P3HT/PCBM interface and suppresses macrophase separation.

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