High Performance and Flexible Organic Thermoelectric Generators Prepared from Donor-Acceptor Type Polymer-CNT Composites

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Organic thermoelectric (TE) devices have great attention as sustainable energy sources for next-generation electronics. Recent advances in TE materials based on soluble conjugated polymer-carbon nanotube (CNT) composites have promised high TE properties, but the TE properties of the materials need to be further improved to chase the commercialized inorganic TE materials. Here, we introduce a novel type of polymer-CNT composites consisting of various donor-acceptor (D-A) type polymers and few-walled CNTs (FWCNTs). The D-A polymers effectively disperse FWCNTs, leading to much smaller CNT bundle sizes and thereby enhanced electrical percolation compared to the composites with P3HT. As a result, the D-A polymer-FWCNT composites exhibited high TE power factors up to 369 μW/m·K2, about 2 times larger than those of the composites with P3HT. Finally, we fabricated large-area and flexible TE generators with D-A polymer-FWCNT composites, exhibiting maximum power output of 0.21 μW (ΔT = 20 K).