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An Alternative Processing Strategy for Polymer-Fullerene Organic Photovoltaic Devices Using Supercritical Carbon Dioxide JOJO AMONOO, Applied Physics, University of Michigan, EMMANOUIL GLYNOS, Material Science and Engineering, University of Michigan, CHELSEA CHEN, Macromolecular Science and Engineering, University of Michigan, ANTON LI, Material Science and Engineering, University of Michigan, BONG-GI KIM, Macromolecular Science and Engineering, University of Michigan, JINSANG KIM, PETER GREEN, Material Science and Engineering, University of Michigan — Bulk heterojunction thin film polymer solar cells based on poly(3-hexylthiophene) (P3HT)/phenyl-C61-butyric acid methyl ester ($PC_{61}BM$) donor/acceptor blends have received extensive attention in recent years. Well-established processing protocols, such as heating to elevated temperatures, have been employed to obtain optimum three-dimensional nano-scale morphologies critical for enhanced device performance. We show for the first time that supercritical carbon dioxide ($scCO_2$) processing provides a viable alternative strategy to achieve same or better power conversion efficiencies and short circuit currents compared to high temperature thermal annealing. Furthermore, energy-filtered transmission electron microscopy, and electron energy loss spectroscopy studies show that the same nano-scale morphologies are achieved using $scCO_2$, at an optimized temperature and pressure as those achieved using thermal annealing. Photoconductive atomic force microscopy revealed that the higher efficiency devices possessed larger fractions of photoactive regions throughout the active layer.

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