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Critical Role of Processing on the Thermoelectric Performance of Doped Semiconducting Polymers SHRAYESH PATEL, UC Santa Barbara - Materials Research Lab, ANNE GLAUDELL, MICHAEL CHABINYC, UC Santa Barbara - Materials Department — The ability to convert excess waste heat into useable energy can significantly help meet the global energy demands. One may capture this waste heat through thermoelectrics devices. In a thermoelectric material, the charge carriers transport both electrical current and heat. Consequently, under a temperature difference (ΔT), a carrier concentration gradient results in a voltage (ΔV), which is related to the Seebeck coefficient, $\alpha \quad = -\Delta V/\Delta T$. One of the challenges lies in finding materials that simultaneously have low thermal conductivity (κ), high electrical conductivity (σ), and high Seebeck coefficient (α). Conjugated semiconducting polymers can potentially meet this demand due to their inherent low thermal conductivity and high electrical conductivity through sufficient doping. Here, we report on the critical role of thermal processing on the enhancement of thermoelectric properties of conjugated polymer thin films. These films were doping using three different mechanisms: acid (toluene sulfonic acid), charge transfer (F_4TCNQ), and vapor (fluorinated-alkyl trichlorosilane). These thermoelectrics properties will be correlated to the structural and morphological properties of the doped thin-films through various synchrotron X-ray scattering techniques. Lastly, to further elucidate the charge transport mechanism driving the thermoelectric performance, we report on the temperature-dependent measurements of both the Seebeck coefficient and electrical conductivity.

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