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Nanoscale alignment of interfacial crystallites and effects on electrical properties on oCVD PEDOT polymer ASLI UGUR, Massachusetts Institute of Technology- Department of Chemical Engineering, FERHAT KATMIS, Massachusetts Institute of Technology- Department of Physics, KRIPA K. VARANASI, Massachusetts Institute of Technology- Department of Mechanical Engineering, KAREN K. GLEASON, Massachusetts Institute of Technology- Department of Chemical Engineering — The precise mechanism of charge transport in conducting polymers is not yet fully understood. It can be influenced by multiple factors including, long- and short-range ordering of the polymeric chains, degree of crystallinity, crystallite size, morphology, and defects. Here we demonstrate that the chain orientation of poly (3,4-ethylenedioxythiophene) (PEDOT) can be controlled by oxidative chemical vapor deposition (oCVD) and the controlled orientation is used to understand the efficient transport direction to obtain high electrical conductivity. The parallel polymer backbone to the substrate resulted in higher conductivities compared to the chains that are perpendicularly oriented with respect to the substrate, where the conductivity is measured both in in-plane and out of plane directions. As film thickness decreases, the electrical conductivity reveals a remarkable improvement, up to $\sim$3000 S/cm by using high substrate deposition temperatures. We have correlated the electrical properties with structural features, e.g. the interface, density and domain sizes of the polymer films by using X-ray and electron based diffraction measurements.

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