Solvent-Free Processing of High-Mobility Poly(*3*-hexylthiophene) Structures

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Abstract

"Plastic" artefacts most often are manufactured from the *liquid* state, i.e. polymer melts or solutions. This is enabled by their favourable processing characteristics including reasonably accessible melting temperatures, viscosities and solubiltity when compared to their inorganic counterparts. Selected polymers can, though, be shaped into useful articles also in the *solid* state – and this on a large scale. The most prominent example is polytetrafluoroethylene (PTFE); but also the premier bulk polymer ulta-high molecular weight polyethylene (UHMW-PE) can be processed in such a manner. We will present that similar procedures may be applied to certain grades of the well-known semiconducting poly(3-hexylthiophene) (P3HT) — a polymer that is under intense scrutiny for applications in, for instance, field-effect transistors (FETs) and photovoltaic devices, which currently are manufactured based on solution- or melt-processes. We will demonstrate that this processing scheme has obvious advantages over current solution-based fabrication procedures, including: (*i*) realization of higher molecular order (and, thus, superior charge transport), (*ii*) absence of use of solvents, and (*iii*) potential for roll-to-roll/large-scale fabrication.

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