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Confinement Effects on the Crystalline Features of Poly(9,9-dioctylfluorene)

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Abstract

Typical device architectures in polymer-based optoelectronic devices, such as field effect transistors organic light emitting diodes and photovoltaic cells include sub-100 nm semiconducting polymer thin-film active layers, whose microstructure is likely to be subject to finite-size effects. The aim of this study was to investigate effect of the two-dimensional spatial confinement on the internal structure of the semiconducting polymer poly(9,9-dioctylfluorene) (PFO). PFO melts were confined inside the cylindrical nanopores of anodic aluminium oxide (AAO) templates and crystallized via two crystallization strategies, namely, in the presence or in the absence of a surface bulk reservoir located at the template surface. We show that highly textured semiconducting nanowires with tuneable crystal orientation can be thus produced. The results presented here demonstrate the simple fabrication and crystal engineering of ordered arrays of PFO nanowires; a system with potential applications in devices where anisotropic optical properties are required, such as polarized electroluminescence, waveguiding, optical switching, lasing, etc.