

Abstract Submitted
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Cross-linking high-k fluoropolymer gate dielectrics enhances the charge mobility in rubrene field effect transistors¹ JWALA ADHIKARI, MATTHEW GADINSKI, QING WANG, ENRIQUE GOMEZ, Penn State University — Polymer dielectrics are promising materials where the chemical flexibility enables gate insulators with desired properties. For example, polar groups can be introduced to enhance the dielectric constant, although fluctuations in chain conformations at the semiconductor-dielectric interface can introduce energetic disorder and limit charge mobilities in thin-film transistors. Here, we demonstrate a photopatternable high-K fluoropolymer, poly(vinylidene fluoride-bromotrifluoroethylene) P(VDF-BTFE), with a dielectric constant between 8 and 11. The bromotrifluoroethylene moiety enables photo-crosslinking and stabilization of gate insulator films while also significantly enhancing the population of trans torsional conformations of the chains. Using rubrene single crystals as the active layer, charge mobilities exceeding $10 \text{ cm}^2/\text{Vs}$ are achieved in thin film transistors with cross-linked P(VDF-BTFE) gate dielectrics. We hypothesize that crosslinking reduces energetic disorder at the dielectric-semiconductor interface by suppressing segmental motion and controlling chain conformations of P(VDF-BTFE), thereby leading to approximately a three-fold enhancement in the charge mobility of rubrene thin-film transistors over devices incorporating uncross-linked dielectrics or silicon oxide.

¹Center for Flexible Electronic, Penn State; The Dow Chemical Company

Jwala Adhikari
Penn State University

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