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Pentacene Thin-Film Transistors With Organophosphonate Self-Assembled Monolayer Modified Gate Dielectrics IAN HILL, MATTHEW MCDOWELL, Dalhousie University, JOSEPH MCDERMOTT, JEFFREY SCHWARTZ, STEVEN BERNASEK, JAEHYUNG HWANG, ANTOINE KAHN, Princeton University — Organophosphonate-based self-assembled monolayers synthesized from aliphatic, heterocyclic aromatic, and aromatic moieties were used to modify silicon dioxide gate dielectric in pentacene organic thin-film transistors. Striking improvements in the subthreshold performance of these devices is noted, with a dependence on the molecular species used in fabricating the monolayer. All modified gate dielectrics outperform the untreated surface. As determined by parameters such as the subthreshold slope, threshold voltage magnitude and uniformity, and the on/off ratio, the aromatic species outperform the heterocyclic species, which outperform the aliphatic species. Origins of the improvement, based on energetic alignment of the molecular levels of the SAM and the pentacene, and charge trap densities will be discussed.

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