Roll-to-Roll Fabrication of Flexible Low-operating Voltage Organic FETs using Solution-based Hybrid High-K Dielectrics

Organic field effect transistors (OFETs) are key for flexible, lightweight, and inexpensive electronic devices. Low-voltage operation of OFETs is necessary for many practical applications and all solution-based, low-temperature processes are desirable as they provide a significant cost advantages for scaling to large area roll-to-roll fabrication processes. To meet these challenges the CHM has developed solution-based high-k dielectric coatings consisting of zirconia (ZrO₂) nanoparticles in a polymer composite.

**OFET DEVICE PERFORMANCE**

The drain current-voltage characteristics for an OFET device having a high-k gate dielectric film composition of 50% ZrO₂ nanoparticles is shown in Figure 1. The corresponding gate voltage transfer characteristics shown in Figure 2 demonstrate a threshold voltage of \( V_{th} \approx -0.8 \) V, with device ON/OFF ratio \( \approx 5.0 \times 10^3 \). The charge mobility is 0.08 cm²/(V-s). The devices exhibit a low leakage current of \( \approx 1.6 \times 10^{-6} \) A cm⁻² at an applied voltage of \(-3.5\) V (1 MV/cm).

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