ALUMINIUM OXIDE PREPARED BY ATOMIC LAYER DEPOSITION IN ORGANIC THIN-FILM TRANSISTORS OPERATING AT 2 V: COMPARISON WITH UV-OZONE OXIDATION

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**INTRODUCTION**
Large-area, roll-to-roll fabrication of thin-film circuits demands layer thickness uniformity over large areas. Previously, a 10-nm-thick dry bi-layer dielectric based on aluminium oxide (AlO₃) prepared by UV-ozone oxidation and n-octylphosphonic acid (C₈PA) monolayer prepared by vacuum evaporation has been developed for organic thin-film transistors (OTFTs). Here we compare such OTFTs to similar transistors that incorporate ALD-AlO₃/C₈PA bi-layer.

**AIMS**
- Use atomic layer deposition (ALD) to grow thin layers of AlO₃ for low-voltage OTFTs.
- Compare Al/ALD-AlO₃/C₈PA/pentacene/Au and Al/UV-ozone-AlO₃/C₈PA/pentacene/Au transistors and metal-insulator-metal (MIM) structures.

**EXPERIMENT**
- Two samples incorporated thin ALD-AlO₃ (12.9 nm) and two samples used thicker (36.8 nm) ALD-AlO₃.
- Within each pairing, one sample underwent a 2-minute UV-ozone clean prior to C₈PA assembly.
- All other transistor layers were identical to UV-ozone-AlO₃ (9 nm) OTFTs.
- ALD performed from water and trimethylaluminium (TMA) at 160°C.

**TRANSISTOR MEASUREMENTS**

**RESULTS: MIM STRUCTURES**

**RESULTS: TRANSISTORS**

**FTIR**

**CONCLUSIONS**
- Leakage current density and capacitance are lower for ALD-AlO₃; primarily as a result of the thicker layers.
- C₈PA self-assembly is not affected by the AlO₃ layer or by its treatment.
- UV-ozone-AlO₃ leads to the lowest threshold voltage. Other parameters are comparable to OTFTs with ALD-AlO₃.

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