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X-ray Analysis of Self-assembled Nano-Dielectrics LI ZENG, Northwestern University, RICCARDO TURRISI, University of Milano-Bicocca, JONATHAN EMERY, MARK HERSAM, TOBIN MARKS, MICHAEL BEDZYK, Northwestern University — Organic thin-film transistors (OTFTs) are viewed as the new generation thin-film transistors (TFT) for future low-cost, printable, flexible electronics. A class of materials called self-assembled nano-dielectrics (SAND) with phosphoric acid-based-electron (PAE) building blocks sandwiched between ultrathin layers of high-k inorganic oxide materials has been synthesized. These materials show exceptional large capacitance, insulating properties, and are also suitable for ambient atmosphere fabrication. The hybrid nature of these materials combines the distinct properties of both the organic and inorganic components and can be incorporated into the low-operating voltage semiconductor-based OTFT. Despite the great performance and flexibility of SANDs, fundamental aspects of dielectric behavior remain unexplored. Particularly, the behaviors of the Br counteranions that exist within PAE building blocks are poorly understood. Therefore, long-period X-ray Standing Wave (LP-XSW), which is a powerful technique sensitive to heavy atom distributions, was used to characterize SAND deposited on synthetic Si/Mo multilayer substrates. The elemental distributions of Br and reference elements were extracted from the analysis of XSW data. These accurate measurements are important for better understanding of counteranions distributions, charge transportation, dipole-semiconductors interactions, and future device modeling and engineering.

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