

## **BEOL-compatible Layered Materials for M3D Applications**

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The current challenges in applying Si-based CMOS for massive monolithic three-dimensional (M3D) integration stem primarily from the high-temperature processes required. Emerging materials such as 2D layered materials and oxide semiconductors present promising alternatives as channels for M3D integration due to their unique properties and low thermal budgets. In this context, we demonstrate dual-gated FETs fabricated from WS<sub>2</sub> and WSe<sub>2</sub> using a Si-compatible manufacturing process, showing their application in inverters. Additionally, we employ ALD-grown InO<sub>x</sub> for oxide semiconductors, where our ALD process includes specific measures to reduce and stabilize oxygen defects, thereby enhancing transistor performance by mitigating both negative and positive bias stress. This study underscores the importance of developing new low-thermal-budget additive techniques for heterogeneous multi-material integration and tailored processing methodologies for both 2D layered materials and oxide semiconductors, aimed at advancing M3D integration technologies.