

Abstract Submitted  
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**High Performance Two Dimensional MoS<sub>2</sub> MOSFET with ALD Al<sub>2</sub>O<sub>3</sub> Gate Stacks** HAN LIU, KUN XU, PEIDE YE, Purdue University — We study the growth mechanism of atomic layer deposition (ALD) of Al<sub>2</sub>O<sub>3</sub> on layered MoS<sub>2</sub>. We demonstrate the feasibility of direct growth of Al<sub>2</sub>O<sub>3</sub> on this 2D material by trimethylaluminum (TMA) and water as precursors. Atomic force microscopy study shows that the quality of the Al<sub>2</sub>O<sub>3</sub> film is degraded at elevated temperatures, originated from impeded surface absorption of precursors. We also apply density functional theory (DFT) study of the reaction which is in good agreement with our experimental observations. In addition, we fabricate dual gate MoS<sub>2</sub> metal-oxide-semiconductor field effect transistors (MOSFET). From the transport study we find out the lowering the growth temperature will result in a huge negative threshold voltage shift, which can be improved by either forming gas anneal after Al<sub>2</sub>O<sub>3</sub> deposition or insertion of an Al seeding layer which would facilitate higher growth temperature with better film quality. Further details will be provided in the presentation.

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