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Toward Nano-Electronics Applications of Metal-Insulator Transition Materials - Atomic Layer Deposition of VO_2 and a Selector Device Concept ANTONY PETER, imec, KOEN MARTENS, imec / KULeuven, IULIANA RADU, imec, NUO XU, UC Berkeley, GEERT RAMPELBERG, Universiteit Gent, CHRISTOPH ADELMANN, imec, CHRISTOPHE DETAVERNIER, Universiteit Gent, MARC HEYNS, imec / KULeuven, MALGORZATA JURCZAK, imec — We discuss advances toward applications of Metal-Insulator Transition (MIT) materials in nano-electronics based on the prototypal MIT material VO_2. A fabrication friendly method to deposit VO_2 is required for VO_2 applications. VO_2 films deposited by techniques suitable for manufacturing, including Atomic Layer Deposition (ALD), have typically been non-continuous and have shown a strongly degraded MIT when film thickness was below 40-50 nm. We show how the nanoscale morphology of VO_2 films can be controlled to realize smooth ultrathin (thinner than 10 nm) crystalline films with ALD. We demonstrate that the films possess both a structural and an electronic transition. The film resistivity of ultrathin films changes by more than two orders of magnitude across the MIT. Incipient nanoelectronics based on Metal-Insulator-Transition (MIT) materials currently features promising device concepts that require further development and understanding. A candidate first nanoelectronic application for MIT materials is a selector element, which is used to prevent sneak currents in dense cross bar memory arrays. Making use of simulations we elaborate a device concept for a selector element based on MIT materials such as VO_2 and $SmNiO_3$.

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