2D TMD Channel with 1D ZnO Nanowire for Nonvolatile Channel Trap Memory

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Two-dimensional transition metal dichalcogenides (TMDs) materials have novel possibility of any synergy by mixing with other dimensional materials.[1,2] Here, n-type field effect transistors (FETs) and 2D stack-based nonvolatile channel interface trap memory are fabricated with 2D MoS_2 and 1D ZnO nanowire. In mixed dimensional structure, TMDs and ZnO wire can play as a channel or a gate. For the trap memory, two MoS_2 flakes are stacked each other and deep level electron trap are formed at 1st/2nd MoS_2 channel interface through short cycles of atomic layer deposition (ALD). The ALD cycling effects on MoS_2 is analysed by ultraviolet photoemission spectroscopy. In addition, complementary type memory cell is achieved using n-type trap memory and p-type FET with ZnO nanowire as a common gate.

References

[1] S. B. Desai et al., Science, 354 (2016) 99.
[2] Y. T. Lee et al., Adv. Funct. Mater., 27 (2017), 1703822.

Figures

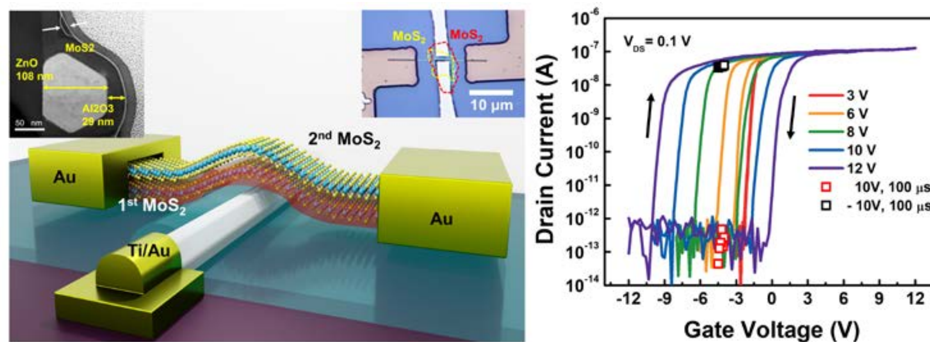

Figure 1: 3D schematic of nonvolatile channel interface trap memory and Cross-sectional STEM image of the memory device, Optical microscopy image of the same memory device, Transfer characteristics of the memory FET.

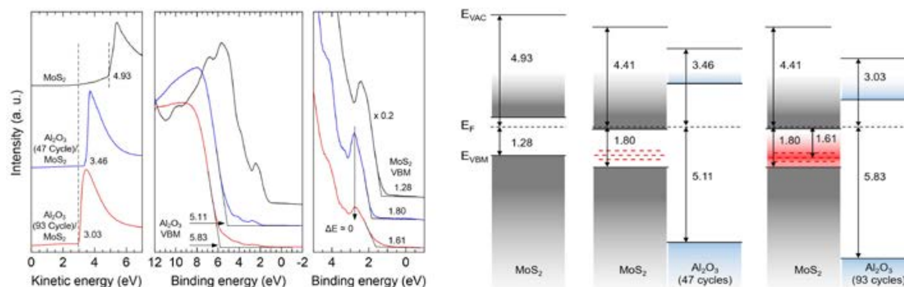

Figure 2: The secondary electron cutoff region of UPS spectra of 2H MoS_2 without and with ALD treatment, UPS spectra showing with fine details near Fermi level to show deep trap state above VBM formed ALD cycle, Band diagram of bulk MoS_2 without and with ALD treatment.