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Chemical patterning and device integration of 2D Bi_2O_2Se

2D semiconductor has been viewed as potential competitor of silicon due to its atomic thickness which is naturally resistant to short channel effect. However, lack of consistency has post a serious limitation on future application of 2D semiconductors. Up to now, most researchers focus on fabricating isolated transistors and evaluate their device performance. In 2017, Wu et al. synthesized a ternary 2D semiconductor[1] Bi_2O_2Se which has shown high electron mobility(~450 $cm^2V^{-1}s^{-1}$) and excellent stability against oxygen and moisture. Meanwhile, the authors demonstrated highly efficient chemical patterning of 2D Bi_2O_2Se and successfully fabricated photodetector arrays[2]. Based on these researches, we are now able to fabricate logic circuits on wet-etched CVD Bi_2O_2Se samples. Figure.1 shows V_{in}-V_{out} curve on thus fabricated inverter. These devices could work in 2V and gain is over 30. More complex circuits are also available.

References

[1] Wu, Jinxiong, et al. Nature nanotechnology 12.6 (2017): 530.
[2] Wu, Jinxiong, et al. Advanced Materials 29.44 (2017): 1704060.

Figures

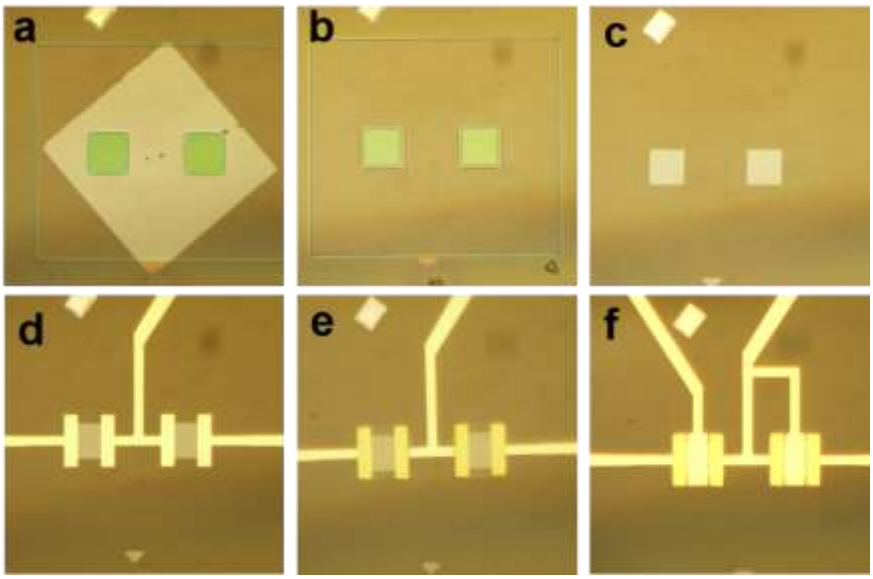

Figure 1: Schematic illustration of fabricating Bi_2O_2Se logic gate. (a) EBL pattering of original sample. (b) Chemical etching of exposed region. (c) Removing PMMA mask. (d) Depositing of S-D electrodes. (e) ALD HfO_2 for gate dielectric. (f) Depositing of gate electrodes and interconnect.

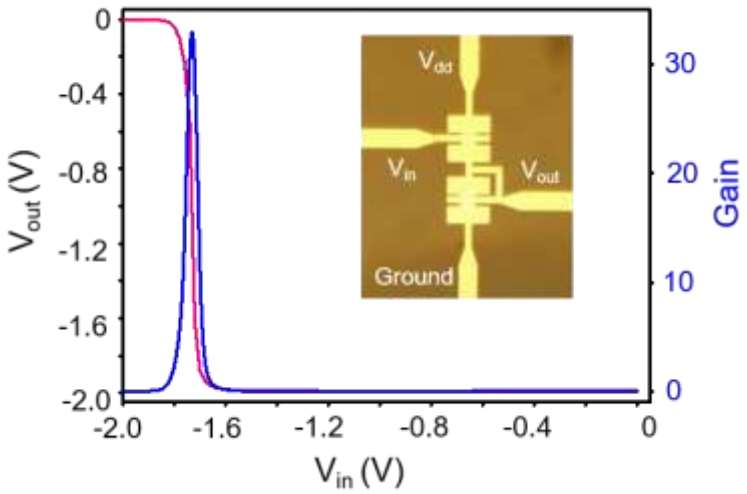

Figure 2: Performance of inverter circuit built on wet-etched 2D-Bi2O2Se.