Supporting information for

Black Phosphorus Nonvolatile Transistor Memory

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Experimental section

Device fabrication: The nano floating gate transistor memories (NFGTMs) with few−layer black phosphorus (BP) were fabricated onto a heavily−doped Si wafer with a 300 nm−thick SiO_2 layer, where Si was utilized as the gate electrode, while SiO_2 was utilized as the blocking gate dielectric layer. The SiO_2 surface was cleaned by UV/ozone treatment (254 nm, 28 mW/cm^2) for 15 minutes. The AuNPs with a diameter of around 9 nm were deposited by thermal evaporation method onto SiO_2 substrate at a rate of 0.01 nm/s. The propylene glycol monomethyl ether acetate (PGMEA) solution composed of 1 wt% poly-4-vinylphenol (PVP, M_w = 20,000 $g$mol^{-1}) and 0.5 wt% poly(melamine−*co*−formaldehyde) (PMF, M_w = 511 gmol^{-1}) was spin−coated onto the AuNPs/SiO_2/Si substrate. The resulting film was thermally annealed in vacuum oven at 180 °C for 2 hrs to generate cross-linking of PVP . Few−layer BP flakes were exfoliated mechanically from bulk BP crystals using a Scotch adhesive tape and then transferred onto the cross−linked PVP (*c*PVP) surface in an Ar glove box to prevent degradation induced by the exposure of the material to water or oxygen during the fabrication processes. The source/drain electrodes (Ni/Au thickness = 20/40 nm) were defined through conventional e−beam lithography processes. Finally, the devices were passivated by spin−coating of 200 nm thick−PMMA (M_w = 200,000) and subsequent baking at 200 °C for 15 minutes.

Measurements: The surface morphology of the mechanically−exfoliated BP flake was obtained by a tapping−mode atomic force microscopy (AFM, D3100 Nanoscope V, Veeco). Raman spectrum was measured by a confocal Raman microscope (Alpha 300R, Witec). The electrical properties of the BP−NFGTMs were measured using Keithley 2400 and 236 source/measure units at room temperature in the dark under vacuum (~10^{-4} Torr).

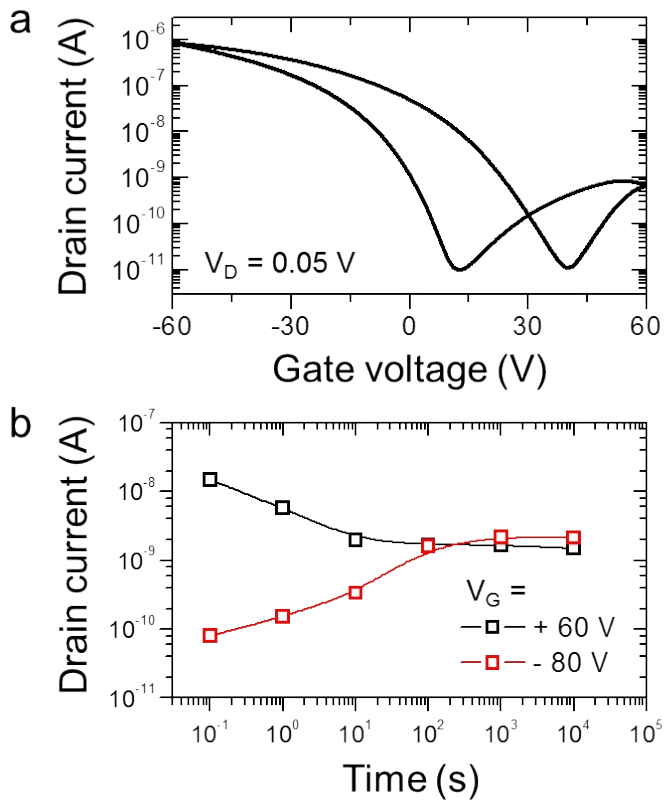

Figure S1. (a) Transfer characteristics and (b) Retention time characteristics of the BP transistors without AuNPs.