Electronic Supplementary Information

Exploring and Suppressing Kink Effect of Black Phosphorus Field-Effect Transistors Operating in Saturation Regime

Ying Xia,‡[a] Guoli Li,‡*[b] Bei Jiang,[a] Zhenyu Yang,[a] Xingqiang Liu,[b] Xiangheng Xiao,[a] Denis Flandre,[b,c] Chunlan Wang,[d] Yuan Liu[b] and Lei Liao*[a,b]

[a.] *School of Physics and Technology, Wuhan University, Wuhan 430072, China. E-mail: liaolei@whu.edu.cn*

[b.] *State Key Laboratory for Chemo/Biosensing and Chemometrics, School of Physics and Electronics, Hunan University, Changsha 410082, China. E-mail: liguoli_lily@hnu.edu.cn*

[c.] *Institute of Information and Communication Technologies, Electronics and Applied Mathematics, Université catholique de Louvain, Louvain-la-Neuve B-1348, Belgium*

[d.] *School of Science Xi'an Polytechnic University, Xi'an 710048, China*

*Corresponding author email: liaolei@whu.edu.cn; liguoli_lily@hnu.edu.cn.

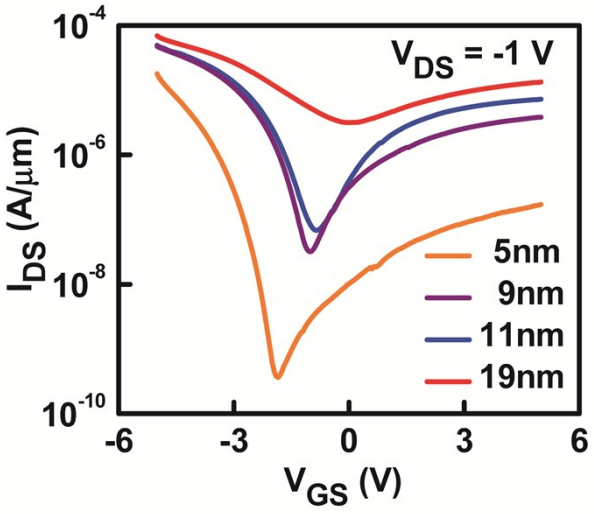

Fig. S1 Transfer characteristics (I_{DS}—V_{GS}) of the BP FETs at V_{DS} = -1.0 V, with various BP thicknesses of ~5, ~9, ~11 and 19 nm and fixed channel length L of 3 μm.

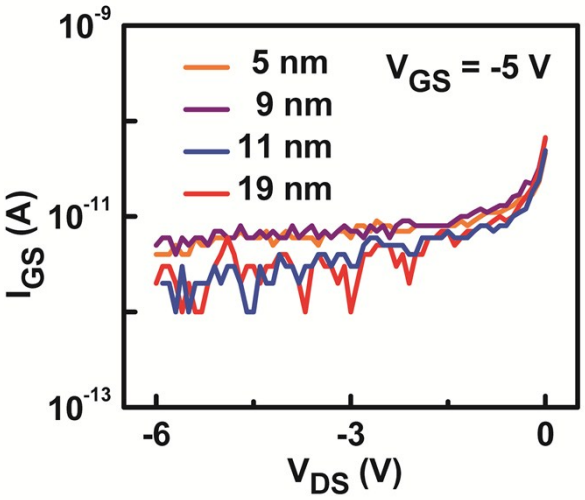

Fig. S2 Leakage current characteristics (I_{GS}—V_{DS}) of the BP FETs at V_{GS} = -5.0 V, with various BP thicknesses of ~5, ~9, ~11 and ~19 nm and fixed channel length L of 3 μm.

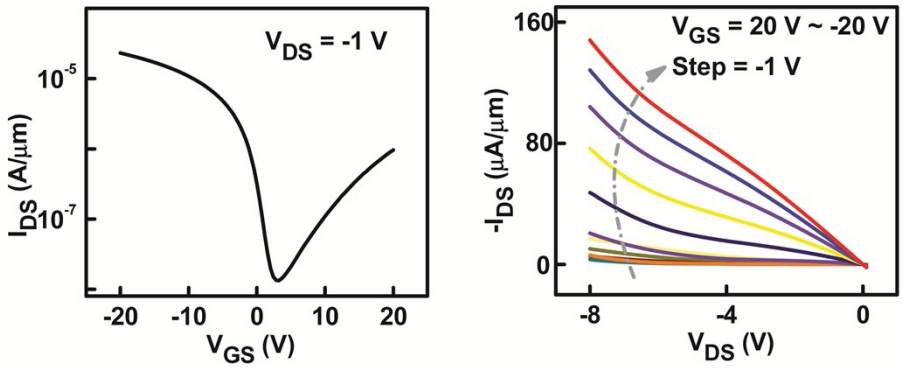

Fig. S3 The transfer (at V_{DS}= -1.0 V) and output (at V_{GS} of 20 ~ -20 V) curves of the BP FETs using a 100 nm-thick SiO_2 layer as gate dielectric and with channel length *L* of 3 μm.

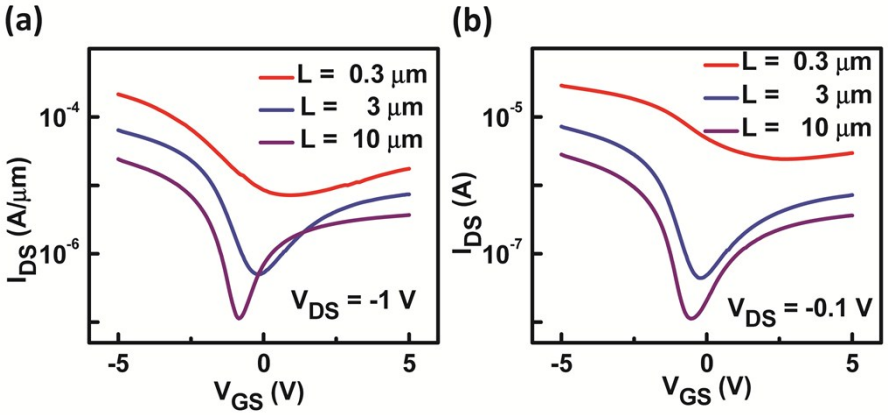

Fig. S4 Transfer (I_{DS}—V_{GS}) curves of the BP FETs at (a) V_{DS} = -1.0 V and (b) V_{DS} = -0.1 V with channel length of 0.3, 3 and 10 μm.

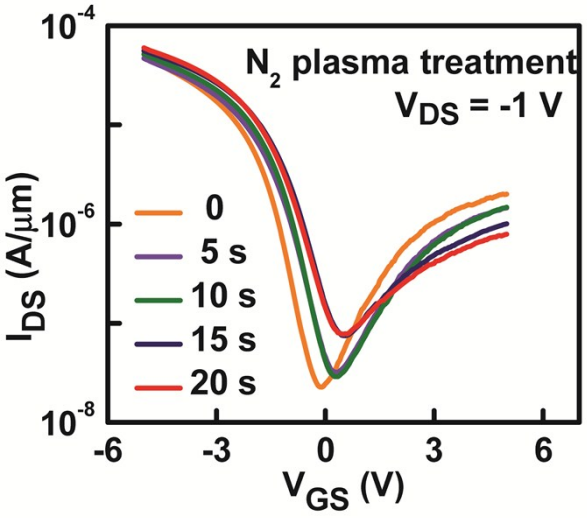

Fig. S5 Transfer characteristics (I_{DS}—V_{GS}) of the BP FETs under different N_2 plasma treatment duration (0, 5, 10, 15 and 20 s) at V_{DS} = -1.0 V