Supporting Information for

Ultraflat Sub-10 Nanometer-Gap Electrodes for Two-Dimensional Optoelectronic Devices

Seon Namgung^{1,2}, Steven J. Koester^{1*}, and Sang-Hyun Oh^{1*}

¹ Department of Electrical and Computer Engineering, University of Minnesota, Minneapolis, Minnesota 55455, United States

² Department of Physics, Ulsan National Institute of Science and Technology (UNIST), Ulsan 44919, Republic of Korea

*E-mail: <u>skoester@umn.edu</u> and <u>sang@umn.edu</u>



Supplementary Figure 1. a) Atomic force microscopy (AFM) image of a nanogap. Sandwiched Al₂O₃ layer between electrodes is observable in a portion of the gap region. b) Height profiles along the lines in the Figure a). Here, different offset is applied to show the profiles in a graph.



Supplementary Figure 2. Leakage current measured from a 10 nm gap platform. Leakage current in the voltage range we used is below the noise level in our measurement system.



Supplementary Figure 3. (a) Transfer and (b) output characteristics of black phosphorus fieldeffect transistor on a 10 nm nanogap platform.