Twofold porosity and surface functionalization effect on Pt-porous GaN for high-performance H_2-gas sensors at room temperature

Muhammad Shafa,[1] Davide Priante,[2] Rami T. ElAfandy,[2] Mohamed Nejib Hedhili,[3] Saleh T. Mahmoud,[1] Tien Khee Ng,[2] Boon S. Ooi,[2] and Adel Najar [,1]*

[1]Department of Physics, College of Science, United Arab Emirates University, Al Ain 15551, UAE

[2]Photonics Laboratory, King Abdullah University of Science and Technology (KAUST), Thuwal 23955-6900, Saudi Arabia

[3] Imaging and Characterization Core Lab, King Abdullah University of Science and Technology (KAUST), Thuwal 23955-6900, Saudi Arabia

E-mail: adel.najar@uaeu.ac.ae; Tel: +971 37136315

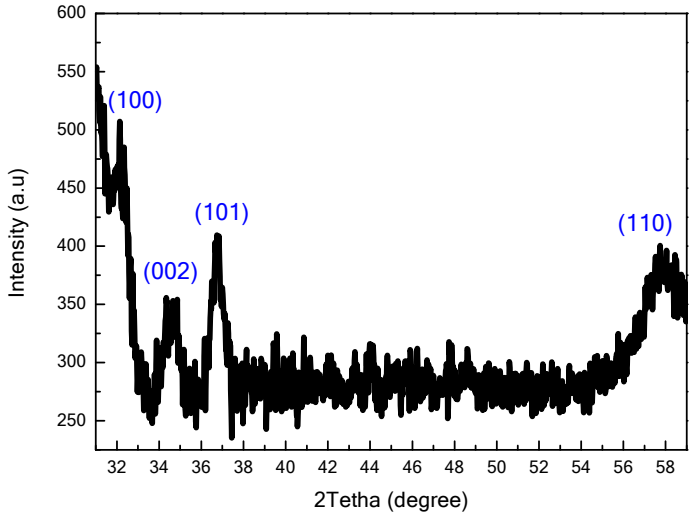

Figure S1. X-ray diffraction pattern of wurtzite of porous GaN nanostructures etched for 30 min in the H_2O_2:HF:CH_3OH (2:1:2) solution under UV illumination

The picks on the spectrum in Fig. S2 can be indexed to the wurtzite GaN (JCPDS card no. 898624) with lattice constants of a= 0.3186 nm and c= 0.5178 nmand the diffraction peaks are located at 2Θ = 32.3^o, 34.5^o, 36.7^o, and 57.8^o corresponding to (100), (002), (101) and (110) planes.

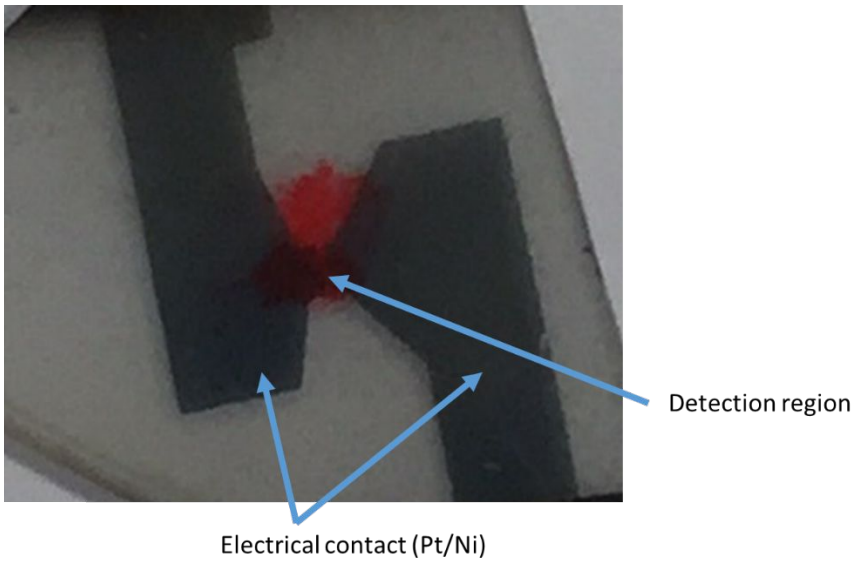

Figure S2. Optical microscope image of the fabricated H_2 gas sensors device.

Figure S2 shows an optical microscope image of one of the fabricated device of gas sensor. The device is formed by two electrical pads used for electrical contact (Pt/Ni). The area between the two pads with a gap equal to 1 mm form the active area where is formed by porous GaN and Pt nanoparticles.

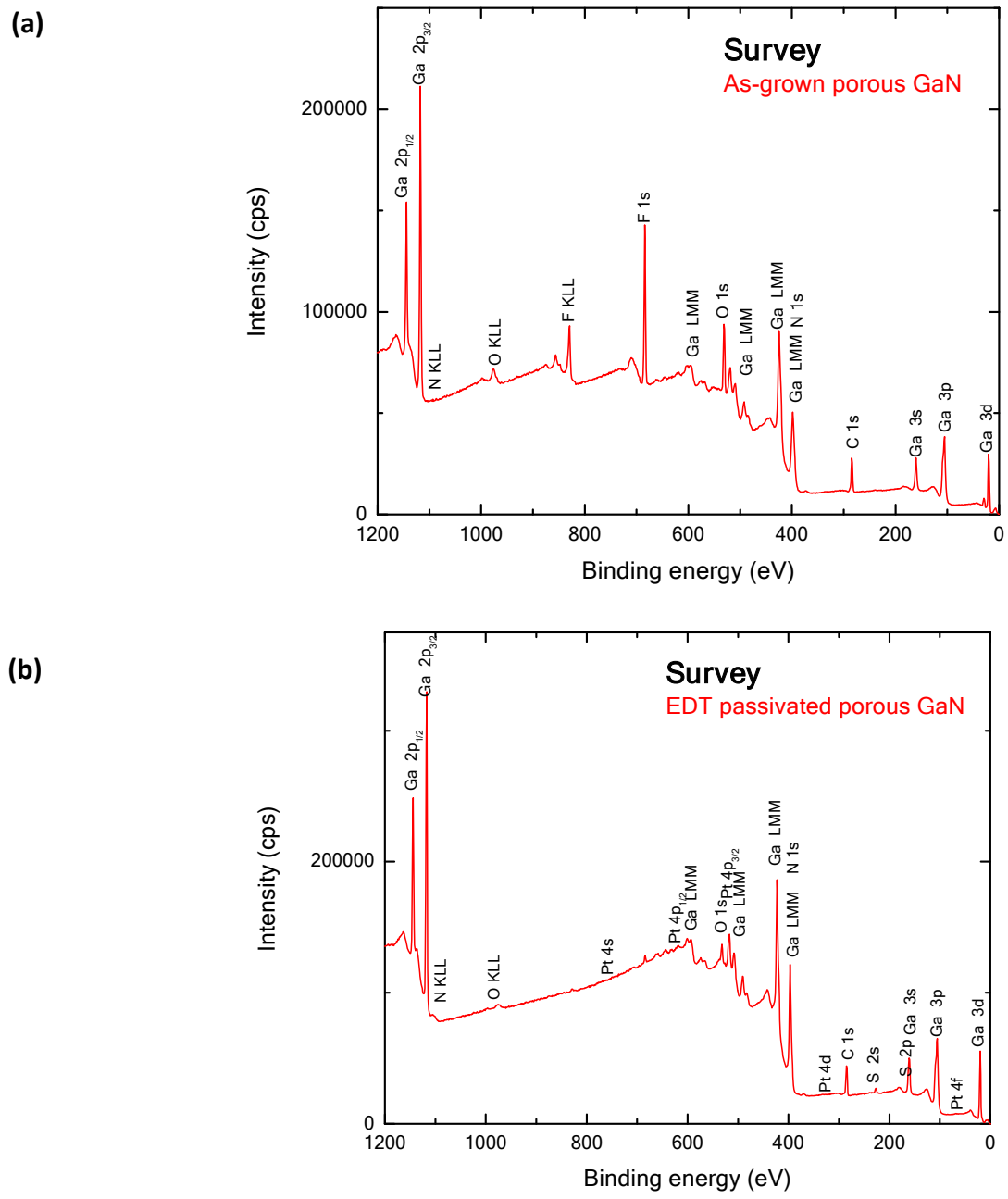

Figure S3. XPS spectra survey comparison of (a) porous GaN and (b) sulfide treated porous GaN.

Full survey spectra of both samples. You can notice the relative strong S 2s peak in the EDT passivated sample. Fluorine (F 1s) emerges in the first image due to HF treatment to make the pores. The EDT passivated sample doesn't show such peak maybe due to sample washing with DI

water after ulterior HF cleaning to remove any surface oxides. Also, Pt element were detected on the treated samples, their concentration is near the limit of the detection of the XPS machine.