Supporting information for:

Au nanoparticles-decorated porous gallium nitride as ultrasensitive substrates for surface enhanced Raman spectroscopy

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The scanning electron microscope (SEM) images were acquired on a Hitachi S4800 SEM and the surface roughness of samples was achieved by AFM-Dimension 3100. All SEM images were taken at 0 tilt angle and 4.2 mm working distance, with 20 kV accelerating voltage. The X-ray diffraction (XRD) patterns were obtained by D8 Advance of Bruker AXS. Raman spectra were obtained on a LabRam HR 800 confocal Raman microscopy with532.8 nm laser. UV-vis spectra were obtained on a LAMBDA 750 UV/Vis/NIR Spectro-photometer(PerkinElmer).
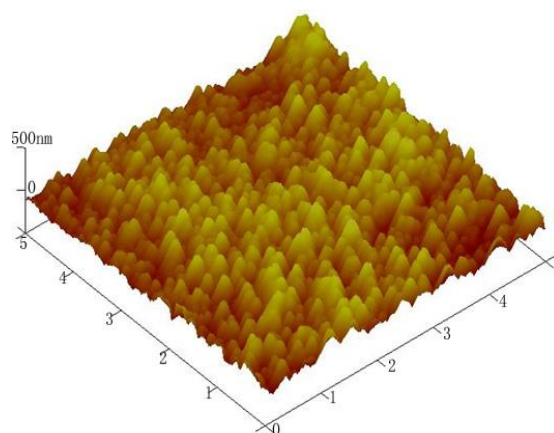

Fig. S1. AFM image of PGaN prepared by PEC etching in 0.5 $molL^{-1}$ H_2SO_4. The applied voltage was 6 V, and the etching time was 15 min.
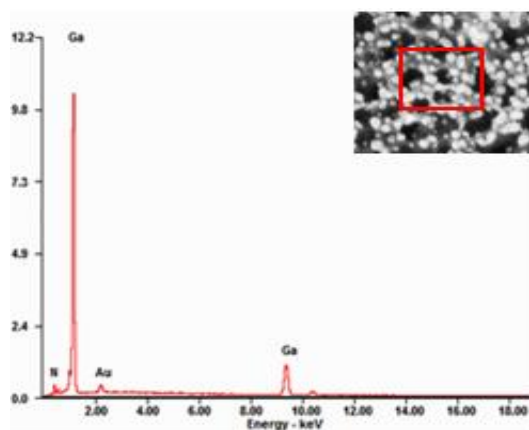
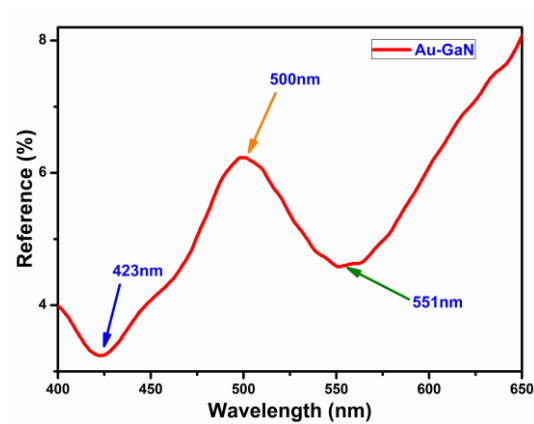**Fig. S2.** EDX spectrum of Au/PGaN substrate.

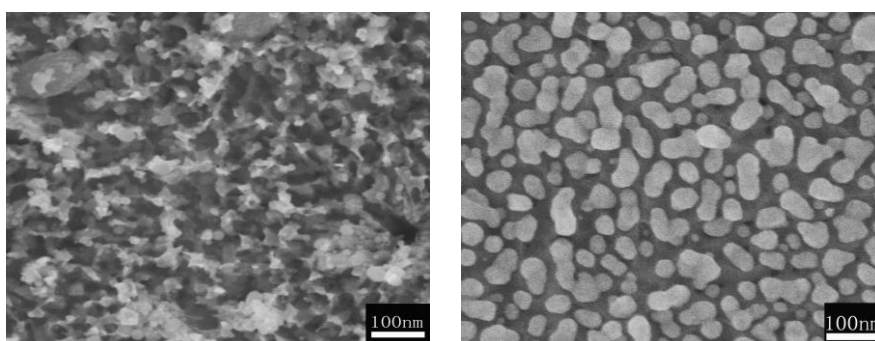**Fig. S3.** Specular reflectance spectrum of Au/PGaN substrate.

Fig. S4. SEM images of Au/PGaN substrates prepared with different cycles: (a) 2 and (b) 10 cycles.
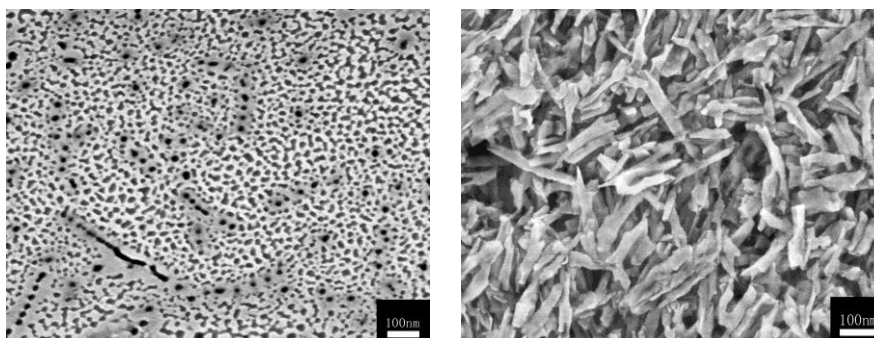
Fig. S5. SEM images of PGaN substrate prepared by PEC etching with different etching time: (a) 7 and (b) 25 min.
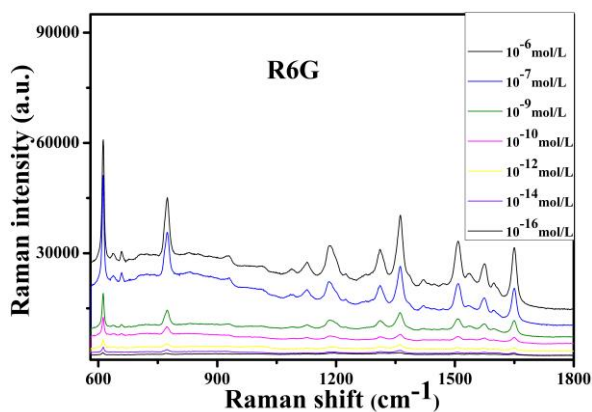

Fig. S6. Raman spectrum of different R6G concentration: 10^{-6}, 10^{-7}, 10^{-9}, 10^{-10}, 10^{-12}, 10^{-14} and 10^{-16} molL^{-1}.

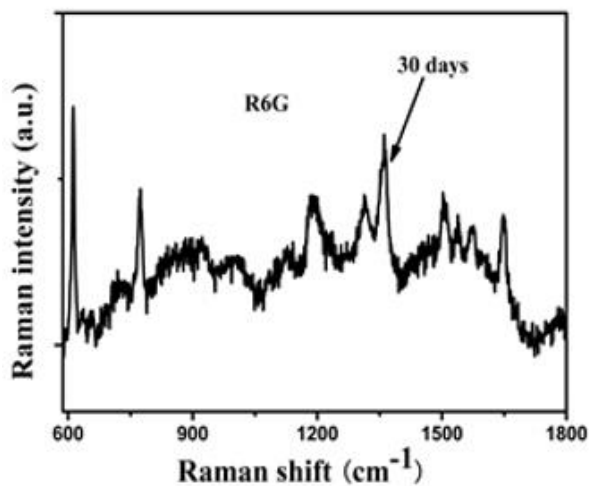**Fig. S7.** Raman spectrum of 10^{-16} molL^{-1} R6G recorded after 30 days storage in air.