

**Supporting Information for:**

**A visualization method for quickly detecting Nitrite ions in breath condensate using a portable close bipolar electrochemical sensor**

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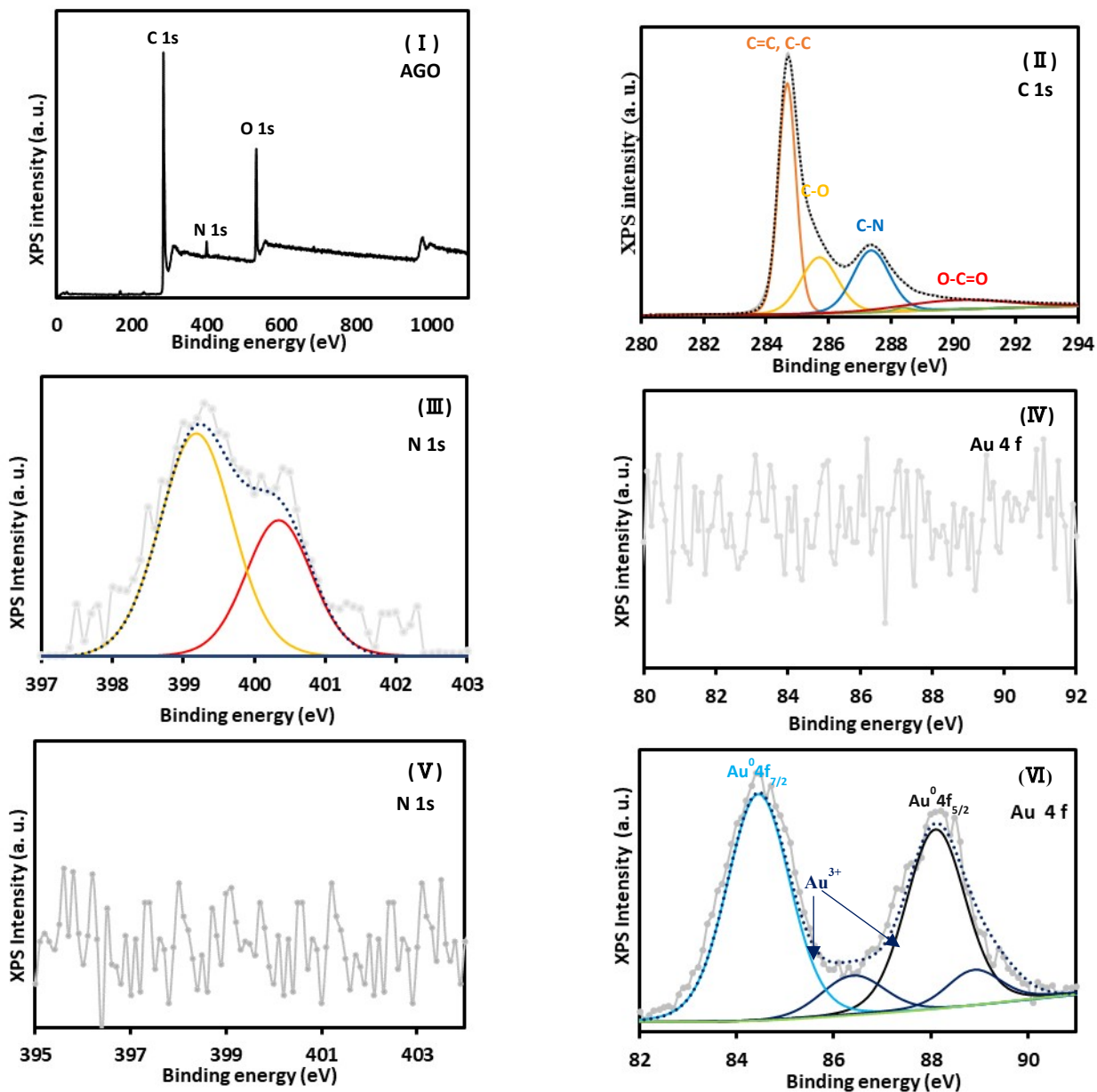
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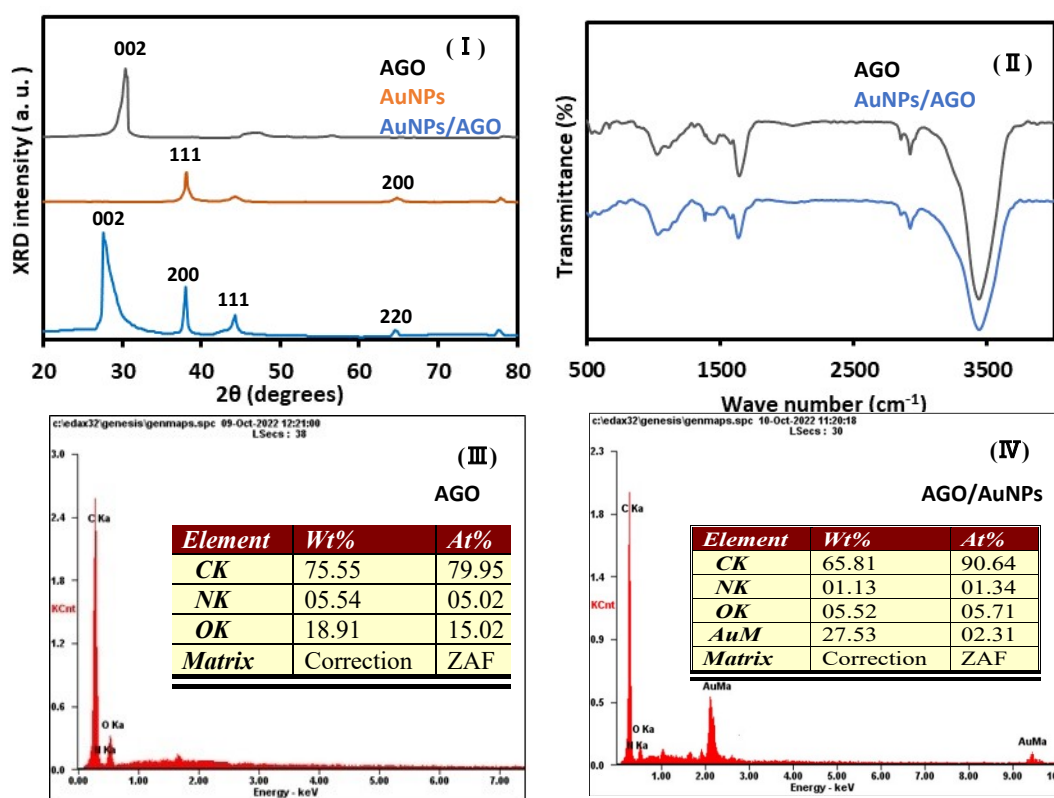
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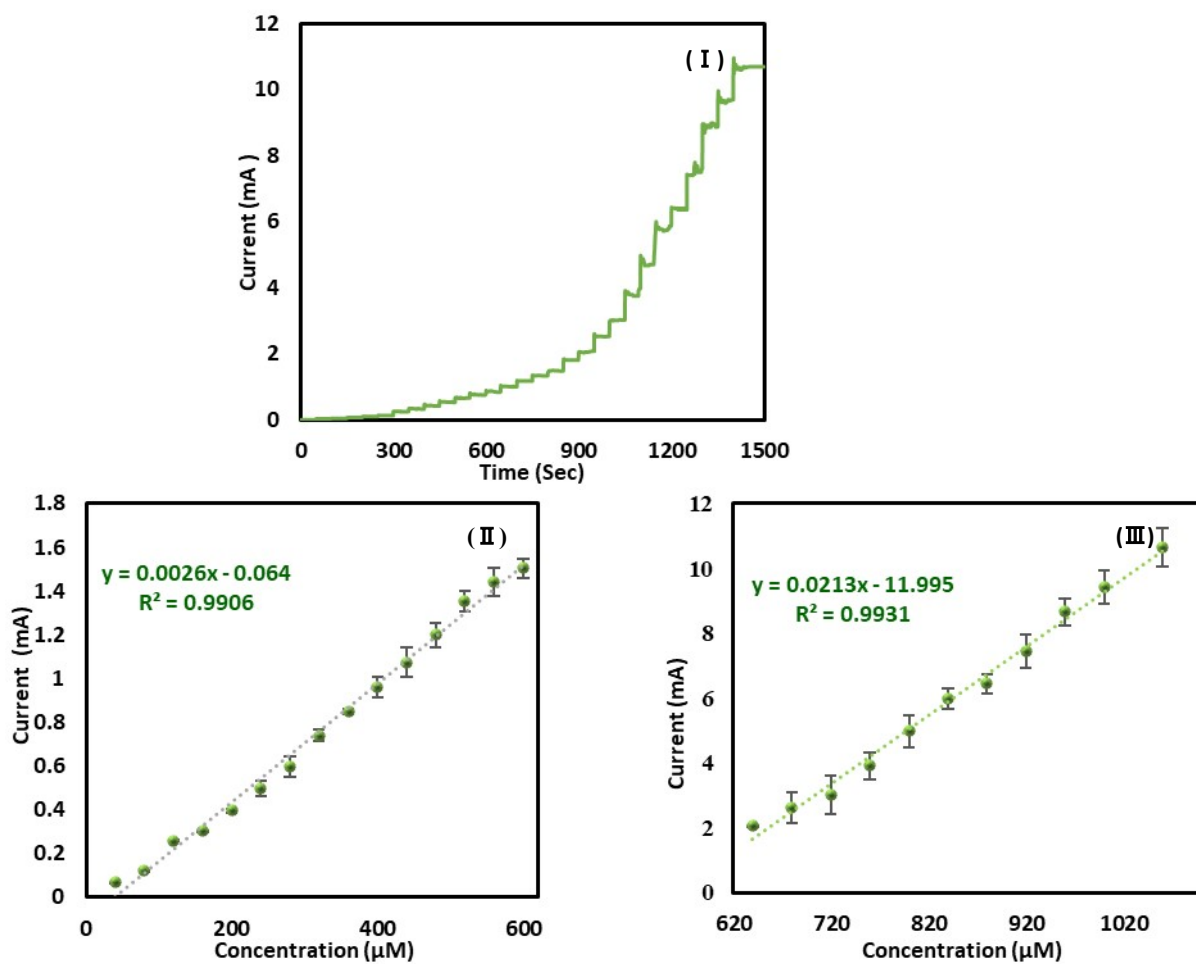


**Figure S1** (I) XPS survey spectra of AGO. (II) High-resolution XPS of AGO in the region of C 1s. (III) AGO in the region of N 1s, (IV) AGO in the region of Au 4f. (V) AuNPs in the region of N 1s. (VI) High-resolution XPS of AuNPs in the region of Au 4f.

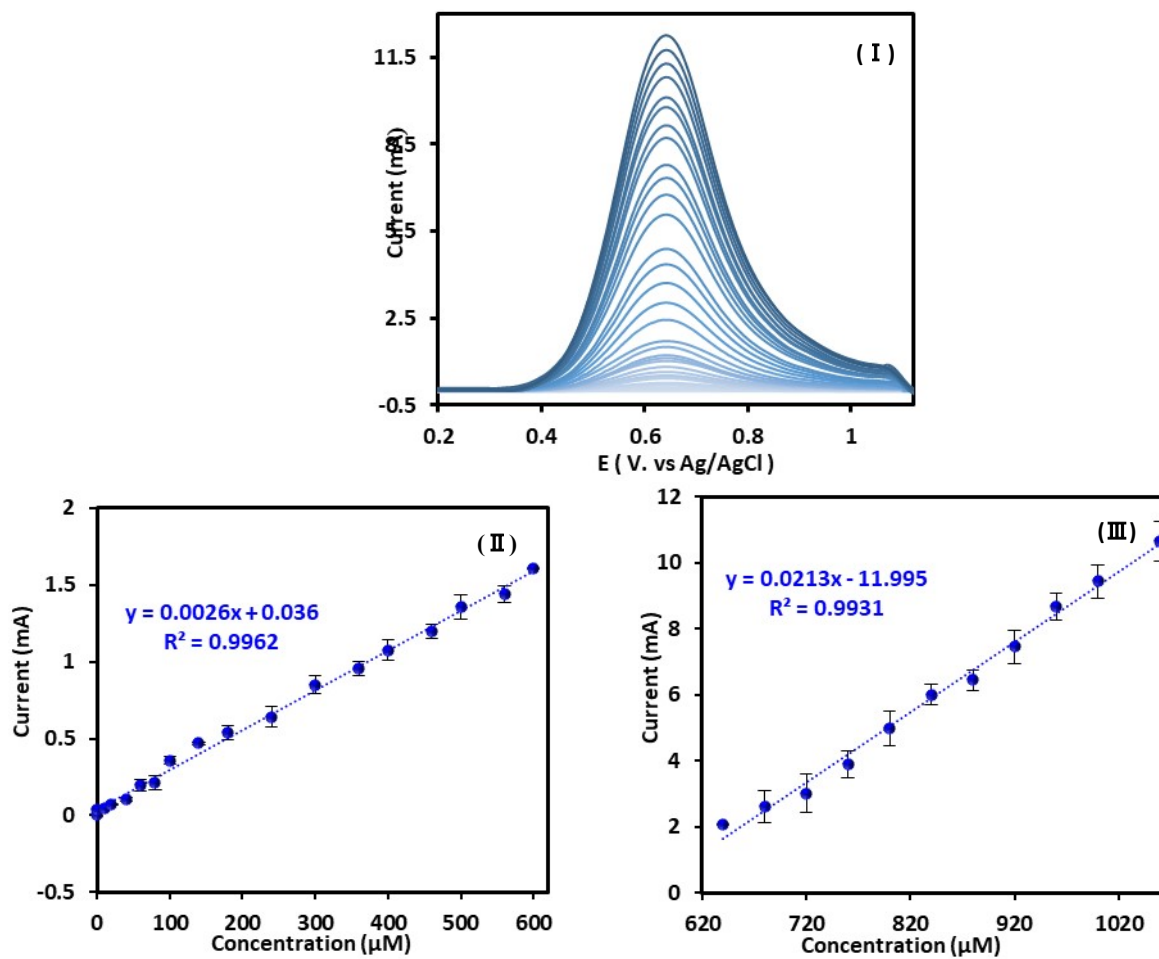
**XRD and FTIR characterization of AuNPs/AGO.** The XRD patterns of pristine AGO, AuNPs, and AuNPs/AGO are depicted in Figure S2 (I). The main diffraction peaks at Au 111 ( $38.0^\circ$ ), Au 200 ( $44.3^\circ$ ), and Au 220 ( $65.3^\circ$ ), (JCPDS card no. 04-0784) of Au face-centered cubic structure, indicating AuNPs successfully loaded on the surface of AGO. The crystallite size of AuNP is calculated from the Au 111 diffraction line using Scherrer's equation. The average size of AuNPs is calculated to be about 6.2 nm. XRD patterns of AGO 002 reflections, which correspond to the coherent and parallel stacking of graphene like-sheets, whereas 100 reflections represent the honeycomb structure formed by  $sp^2$  hybridized carbons. In Figure S2 (II), the results of the analysis showed that functional groups were present in AGO and ink (AGO/AuNPs). The wide and strong peaks at about  $3425\text{ cm}^{-1}$  correspond to the stretching vibration of the O-H bond and N-H bond due to the adsorbed  $\text{H}_2\text{O}$  molecules and alcohol O-H groups or carboxyl groups, as well as the amine functionalized on graphene. The peak at  $15470\text{ cm}^{-1}$  (vibration of C-C and C-N) and  $2921, 2852\text{ cm}^{-1}$  (carbon-hydrogen bonds C-H),  $1640\text{ cm}^{-1}$  (C=O),  $1304\text{ cm}^{-1}$  (O=C-O), and  $1026\text{ cm}^{-1}$  (C-O). As expected, the spectrum shows that after electrodeposition of gold nanoparticles to AGO, there is no change in functional groups.



**Figure S2 ( I )** XRD patterns of AGO, AuNPs, and AuNPs/ AGO. **( II )** FTIR spectrometry of AGO, and AuNPs/ AGO. **( III )** EDS single spectra of AGO. **( IV )** EDS single spectra of AuNPs/ AGO.



**Figure S3 ( I )** Current–time curve of AuNPs/AGO/CP electrode in 0.2 M BRB (pH = 6.0), and  $E = 0.65$  V solution containing different concentrations of  $\text{NaNO}_2$  from 40 to 1060  $\mu\text{M}$ . The relation between oxidation current versus the concentration of  $\text{NaNO}_2$ , **( II )** 5 to 600  $\mu\text{M}$ , **( III )** 640 to 1060  $\mu\text{M}$ .



**Figure S4 (I)** DPV curves of the AuNPs/AGO/CP electrode in 0.2 M BRB (pH = 6.0) solution containing different concentrations of NaNO<sub>2</sub> from 1 to 1230 μM. **(II)** The relation between oxidation current versus the concentration of NaNO<sub>2</sub>; 1.0 to 400 μM. **(III)** 440 to 1230 μM.

