

# Flexible and Disposable Sensing Platforms based on Newspaper

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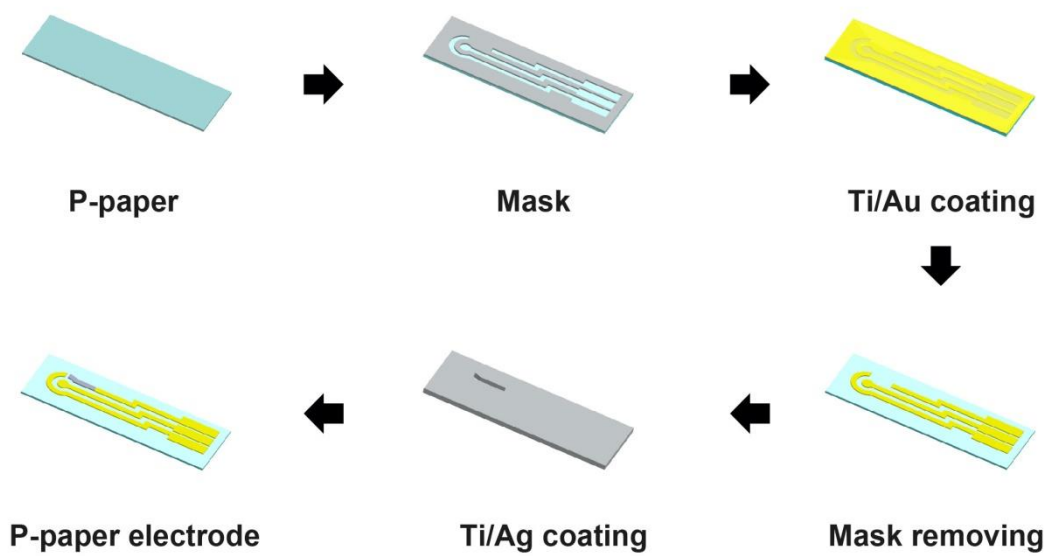
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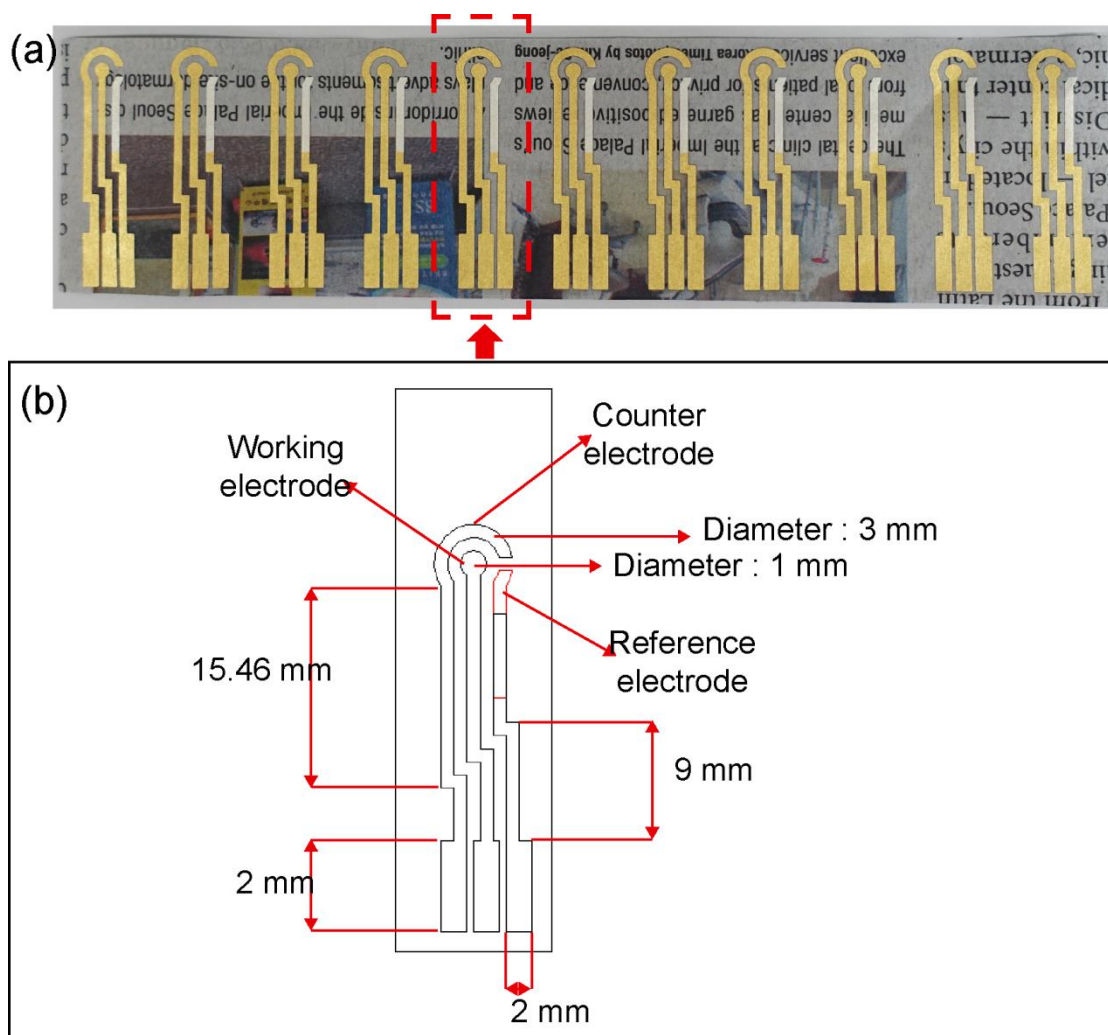
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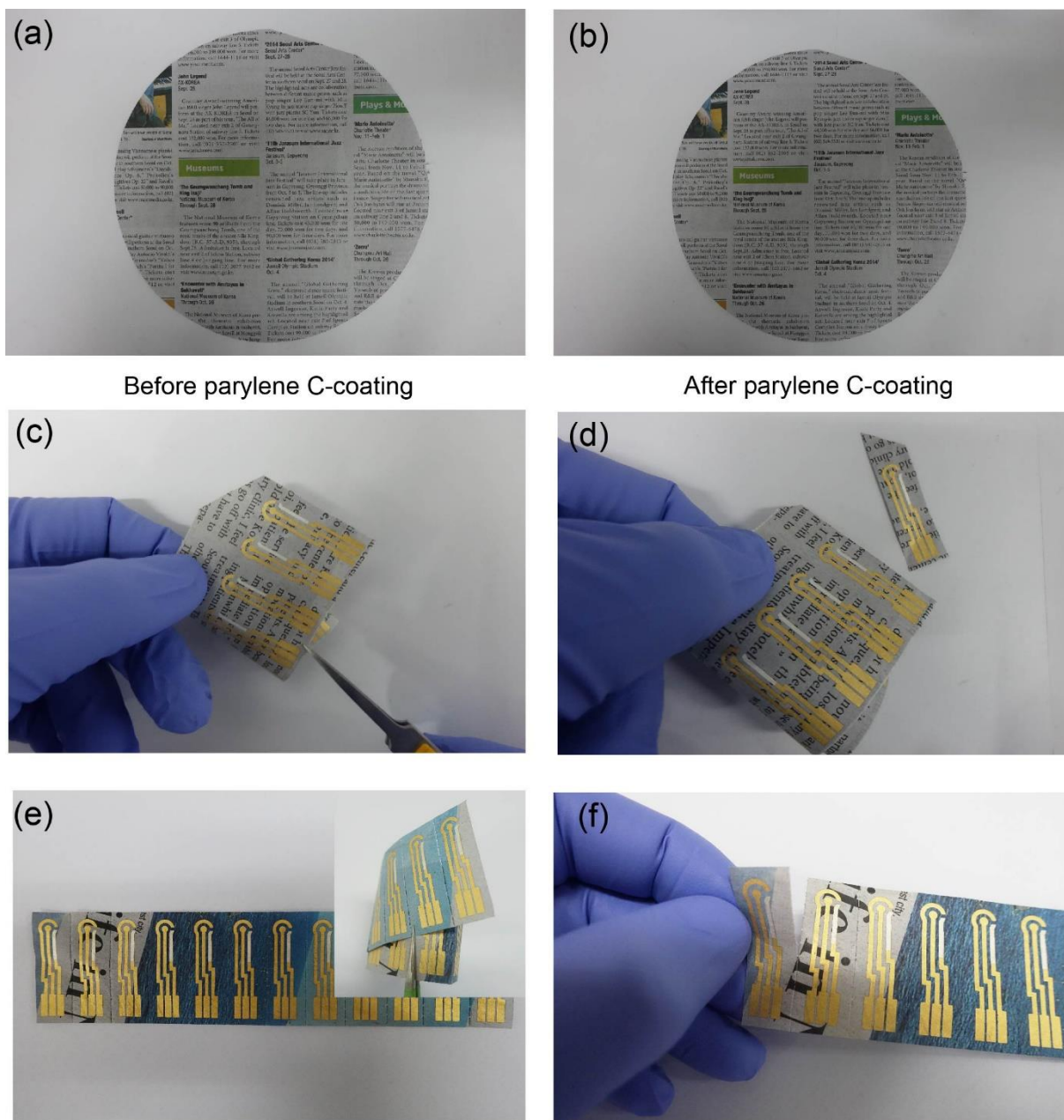
*E-mail address:* kglee@nnfc.re.kr; sjlee@nnfc.re.kr; bgchoi@kangwan.ac.kr



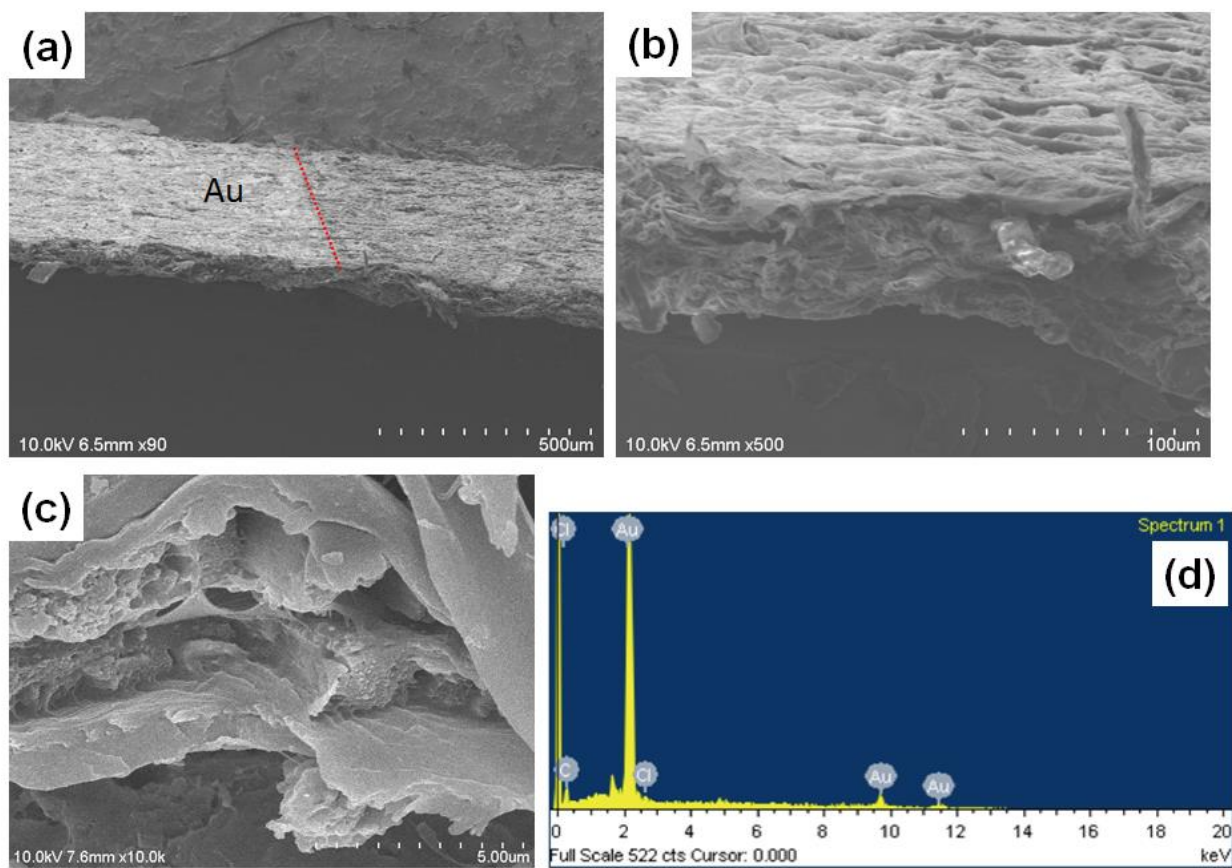
**Figure S1.** Fabrication process of the P-paper electrode (Ti: adhesion layer, Au: working and counter electrode, Ag: reference electrode).



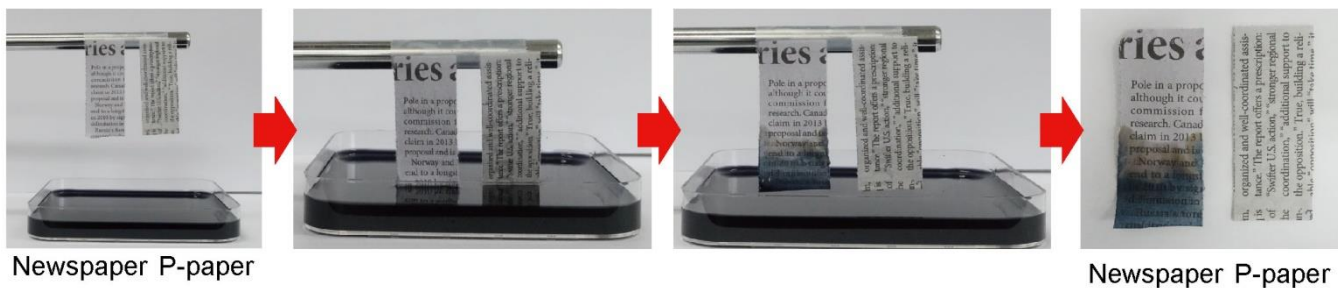
**Figure S2.** (a) Picture of Au and Ag-coated P-paper electrodes. (b) Design and dimensions of P-paper electrode.



**Figure S3.** Photographs of newspaper (a) before and (b) after parylene C coating. Photographs of (c) rolled P-paper electrodes and (d) an individual P-paper electrode after cutting of P-paper electrode sheets using a scissors. The dotted cutting line on (e) P-paper sheet and (f) tearing off the P-paper electrode using human hands.



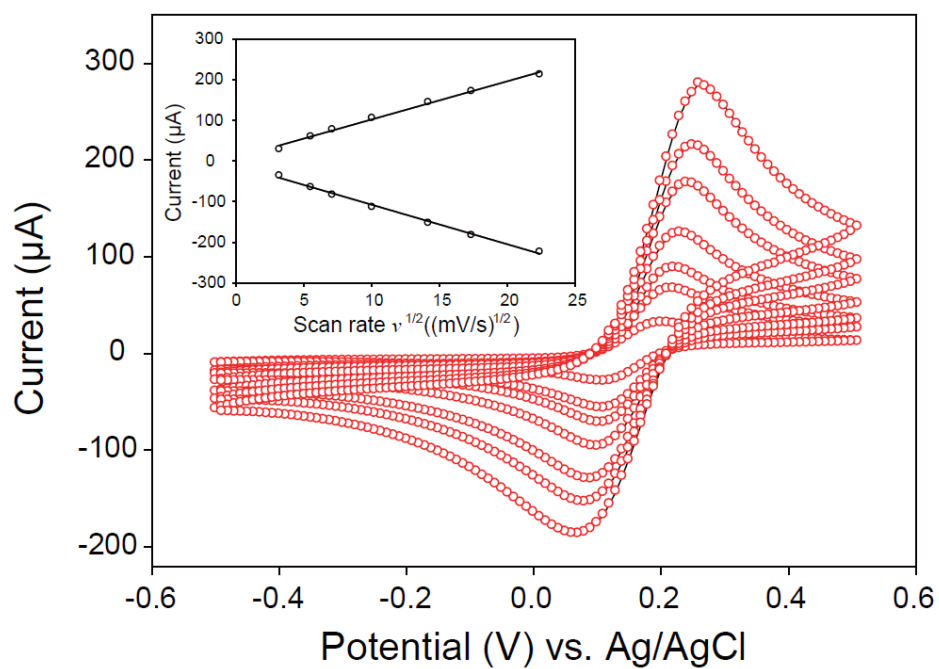
**Figure S4.** (a-c) Cross-sectional SEM images of Au-coated P-paper electrode with different magnitudes and (d) EDX spectrum of P-paper electrode.



Newspaper P-paper

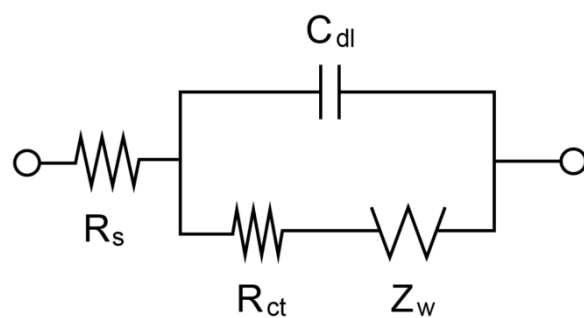
Newspaper P-paper

**Figure S5.** Photographs of pristine newspaper (left) and P-paper (right) before and after immersing into black ink.



**Figure S6.** CV curves of P-paper electrode after 100 folding fatigue test at various scan rates.

Inset shows corresponding relationship between peak currents and square root of scan rates.



**Figure S7.** Equivalent Randle circuit model used for the fittings, where  $R_s$  represents the internal resistance of the circuit,  $R_{ct}$  and  $C_{dl}$  are the charge transfer resistance and double layer capacitance at electrode, respectively, and  $Z_w$  is associated with the Warburg impedance corresponding to diffusion process of redox probe.





**Movie S1.** Captured image from supporting movie for wetting resistance of P-paper after random folding.



**Movie S2.** Captured image from supporting movie for the burnable P-paper **electrode**.

**Table S1.** Conductivity changes of gold and silver layer on P-paper after adhesion test

Sample	Conductivity (S/m)	
	before	after
Au	$2.54 \times 10^6$	$2.45 \times 10^6$
Ag	$6.90 \times 10^6$	$6.64 \times 10^6$

**Table S2.** Concentration of calcium carbonate released from the paper after leaching test.

Sample	Concentration (ppm)
Pristine paper	2.20
P-paper	<0.01

**Table S3.** Comparison of this work with other reported electrochemical detection of pathogenic DNA.

Electrode used	Label	Techniques used	Analytes	LR	LOD	ref
SPE (Au)	AP	DPV	<i>Listeria monocytogenes</i>	0 – 25 nM	0.75 nM	1
modified GCE (Au@Fe <sub>3</sub> O <sub>4</sub> )	-	DPV	<i>Botrytis cinerea</i>	1 μM – 1.2 mM	0.1 μM	2
GRAVI-Chip (Au)	AP	CA	<i>Legionella pneumophila</i>	0 – 5 nM	0.33 nM	3
SPE (carbon)	-	CP	<i>Escherichiu coli</i>	0.5 – 3.0 μg/mL	ca. 7.11 nM <sup>a</sup> (50 ng/mL)	4
modified SPE (MWNT)	-	EIS	<i>Microcystis spp.</i>	2.5 – 40 μg/mL	1.02 μM	5
Paper electrode (Au)	-	EIS	<i>Escherichiu coli</i> O157:H7	1 nM – 1 μM	0.16 nM	This work

LR: linear range, LOD: limit of detection, SPE: screen printed electrode, GCE: glassy carbon electrode, AP: alkaline phosphatase, DPV: differential pulse voltammetry, CA: chronoamperometry, CP: chronopotentiometry, EIS: electrochemical impedance spectroscopy, <sup>a</sup>: calculated value based on molecular weight of target DNA.

## References

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