Supporting online materials for

High-Response Humidity Sensing with Graphene Oxide/Lignosulfonate and Laser-Induced Graphene for Respiratory Health

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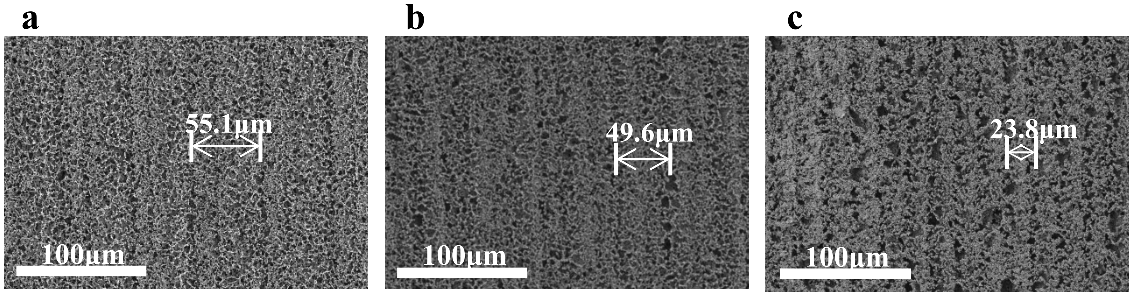

Fig.S1a) SEM morphology of LIG surface at 60% laser power. b) SEM morphology of LIG surface at 80% laser power. c) SEM morphology of LIG surface at 100% laser power.

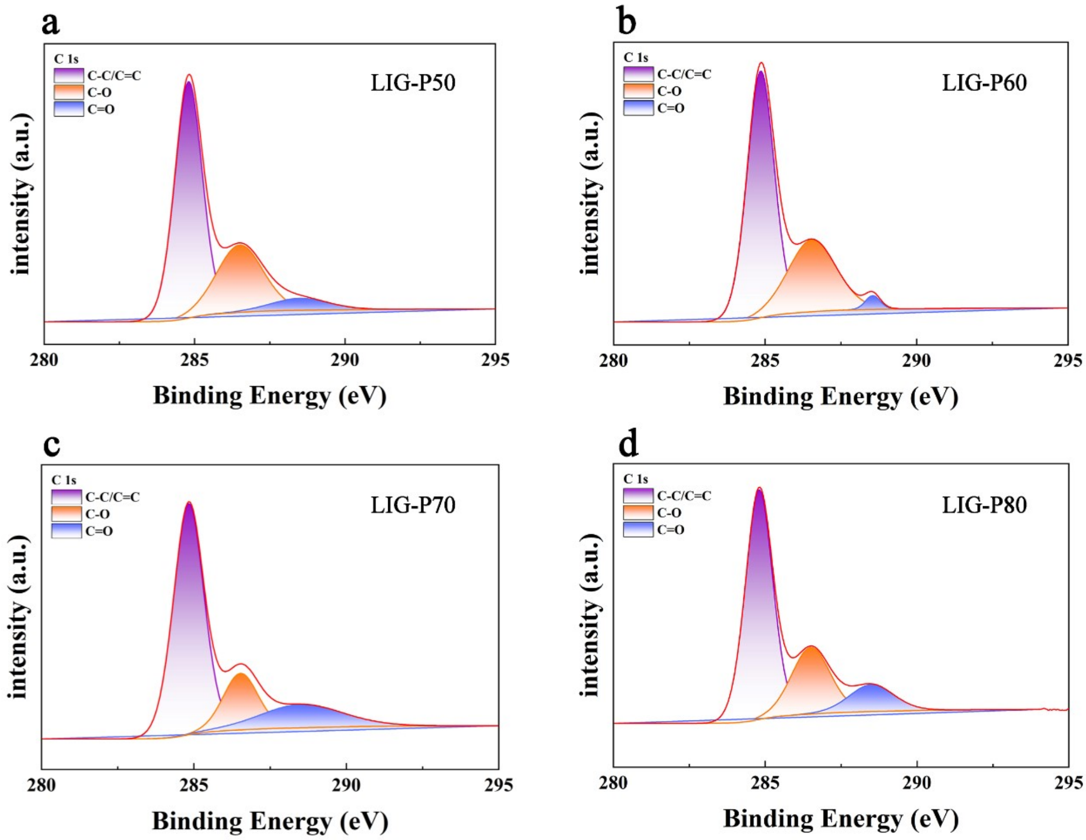

Fig.S2 a) C1s XPS mapping of LIG-P50. b) C1s XPS mapping of LIG-P60. c) C1s XPS mapping of LIG-P70. d) C1s XPS mapping of LIG-P80.

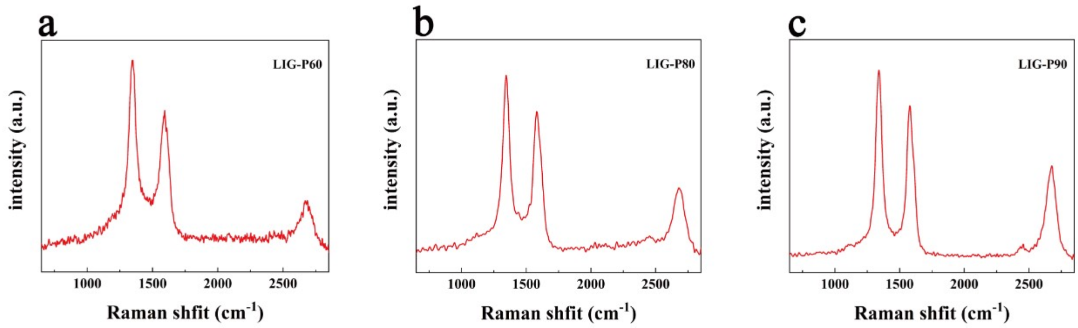

Fig.S3 a) Raman spectra of the LIG-P60. b) Raman spectra of the LIG-P80. c) Raman spectra of the LIG-P90.

Calculation of theoretical detection limit

Thank you very much for your suggestion Our current experimental setup does not allow us to obtain a minimum detection limit for relative humidity. The theoretical detection limits and quantification limits are based on the signal processing performance of the sensor. Sensor noise can be calculated from the change in relative conductivity over the baseline using the mean square... Sensor noise can be calculated from the change in relative conductivity over the baseline using the root mean square deviation (rmsd). The specific process is described below:

First, we collected ten data points at the baseline of the *Current-Time Test* in a dry environment (RH=0%), with an interval of 2 s between each collection.

Time (s)	Current (A)	(Δ I/I)^1/3 (Yi)
0	1.784E-4	0.0094
2	1.763E-4	-0.01083
4	1.781E-4	0.00809
6	1.782E-4	0.00857
8	1.783E-4	0.009
10	1.776E-4	0.00311
12	1.764E-4	-0.01054
14	1.763E-4	-0.01083

16	1.782E-4	0.00857
18	1.779E-4	0.00691

After plotting the data, a fifth-order polynomial fit was executed over the range of data points, yielding not only the curve-fitting equation, but also the statistical parameters of the polynomial fit.

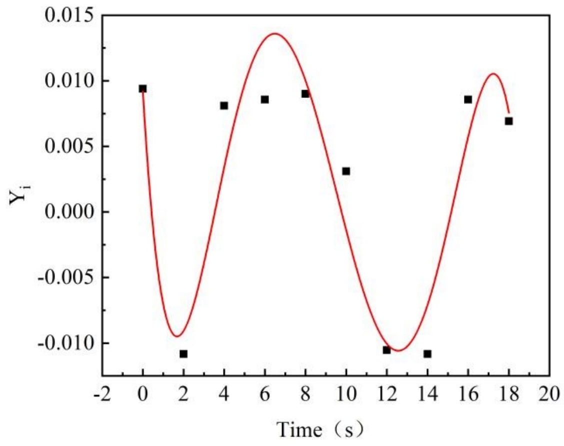

Figure.S4 Fifth-order polynomial fitting equations

The Vχ2 value is then calculated as shown below Vχ2 = Σ (Yi – Y)2, where Yi is the measured data point and y is the corresponding value calculated from the curve-fitting equation.

Time (s)	Yi	Y	$(Yi – Y)^2$
0	0.0094	0.00917	5.18912E-08
2	-0.01083	-0.00907	3.09521E-06
4	0.00809	0.00342	2.18339E-05
6	0.00857	0.01317	2.11359E-05
8	0.009	0.01001	1.01181E-06
10	0.00311	-0.00139	2.02251E-05
12	-0.01054	-0.01004	2.4729E-07
14	-0.01083	-0.00709	1.39825E-05
16	0.00857	0.00573	8.08048E-06

18	0.00691	0.00756	4.2195E-07

Finally, the following steps were followed to find the theoretical limit of detection and limit of quantification.

$rms_{noise} = \sqrt{(V\chi 2 / N)}$ where, N = 10

rms_{noise} =0.003001434

Detection limit=3 x (0.003001434/0.02033) (Slope = 0.02033,the value obtained from Fig. 4f in the text, inset) =0.4429%

Quantification limit=10*(0.003001434/0.02033)=1.4764%

Therefore, the theoretical limit of detection is 0.4429% and the theoretical limit of quantification is 1.4764%.