Supporting Information

Transient and Flexible Photodetectors

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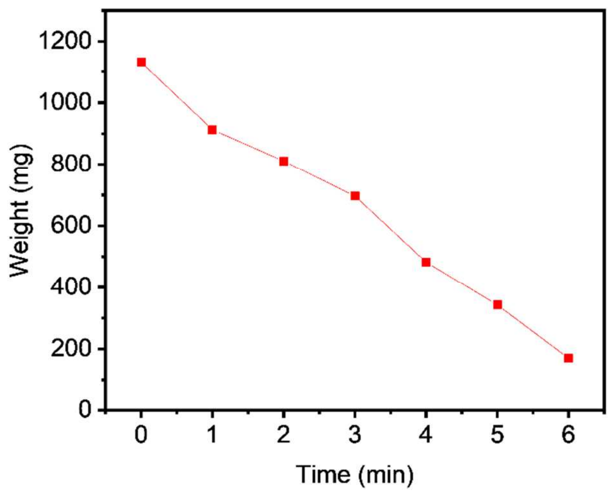

Figure S1. A variation of PVA slab's weight from 0 min to 6 min.

We have done an experiment about the weight loss as a function of time. Figure S1 shows that the corresponding variation of PVA slab's weight immersed into DI water. The weight is linearly decreased in water from 1130 mg (0 min) to 913 mg (1 min), 811 mg (2 min), 696 mg (3 min), 482 mg (4 min), 342 mg (5 min) to 170 mg (6 min).

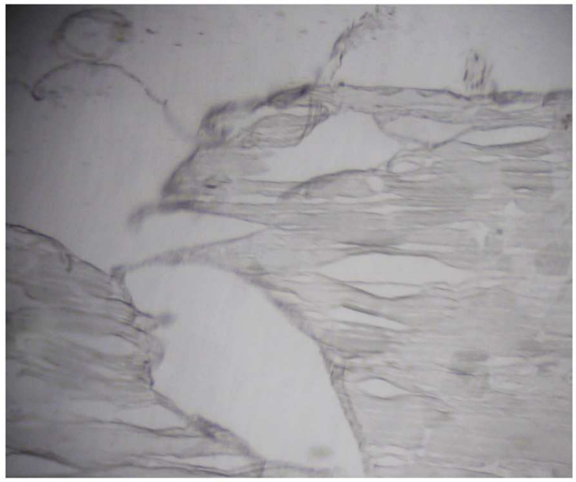

Figure S2. The optical image of graphene with a flake-like structure.

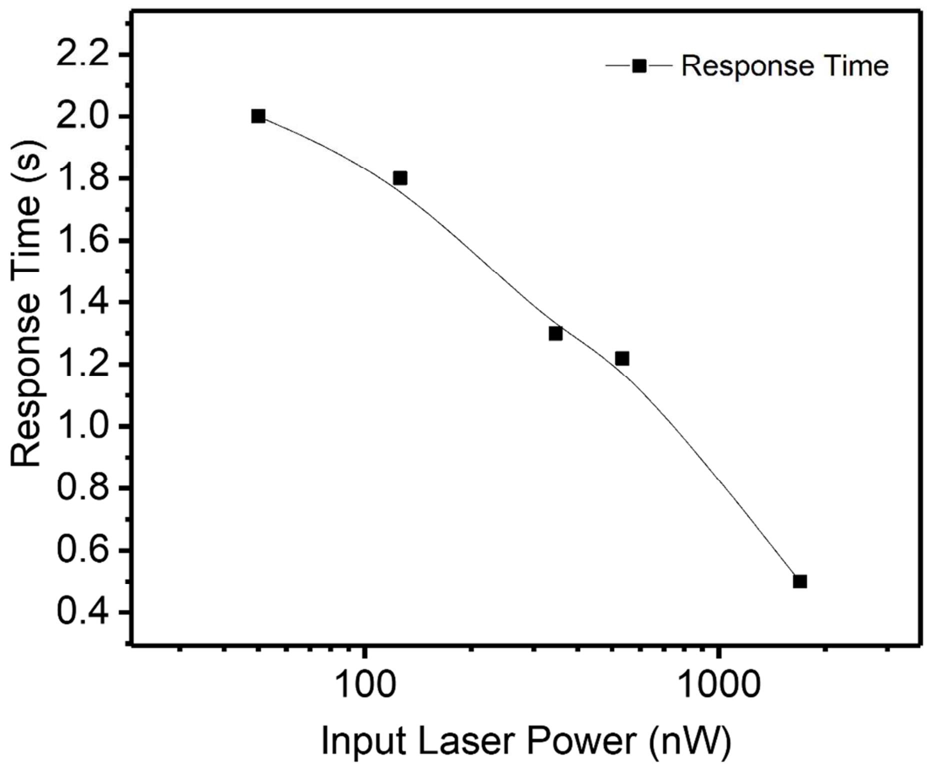

Figure S3. The variation of response time of the device with different input power.

The photodetector off-to-on and on-to-off behavior can be fitted with the following equations

$$\Delta I_{off-to-on} = \Delta I_1\left(1 - e^{-t/\tau}\right) \tag{S1}$$

, where $\boldsymbol{\tau}$ is the response time of the device. The response time is getting shorter with increasing pumping due to the reduced effect of charge trapping by interface defects.

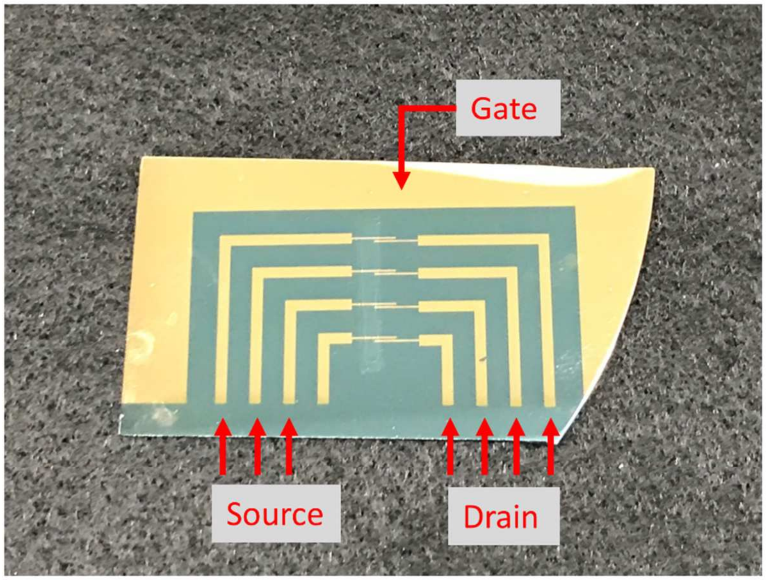

Figure S4. A phototransistor is designed with patterned electrodes in order to transfer graphene on it. The distance between source and drain electrodes is 100 μm.

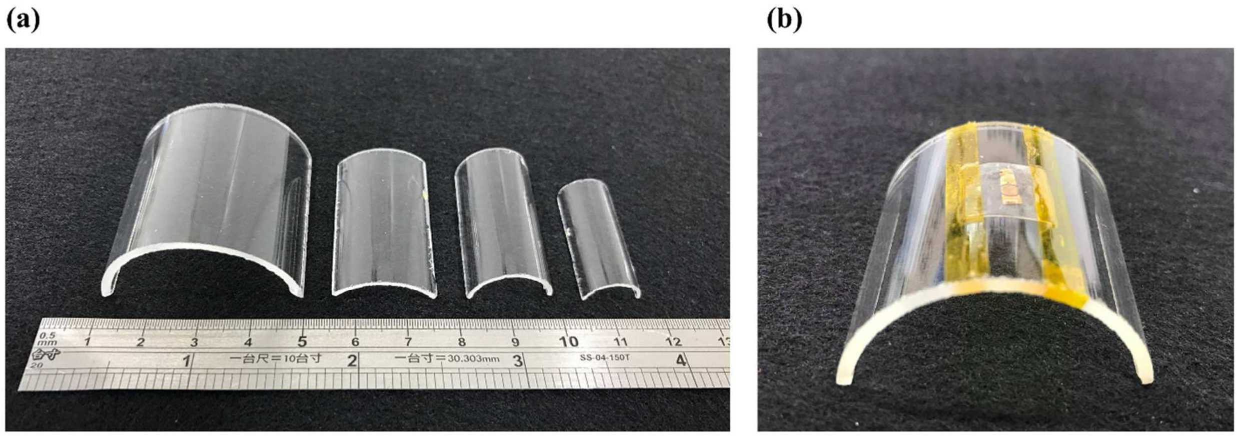

Figure S5. (a) The curvature of the curved substrates, including 1.82 cm, 1.14 cm, 0.74 cm, and 0.52 cm. (b) Photograph of device under bending.

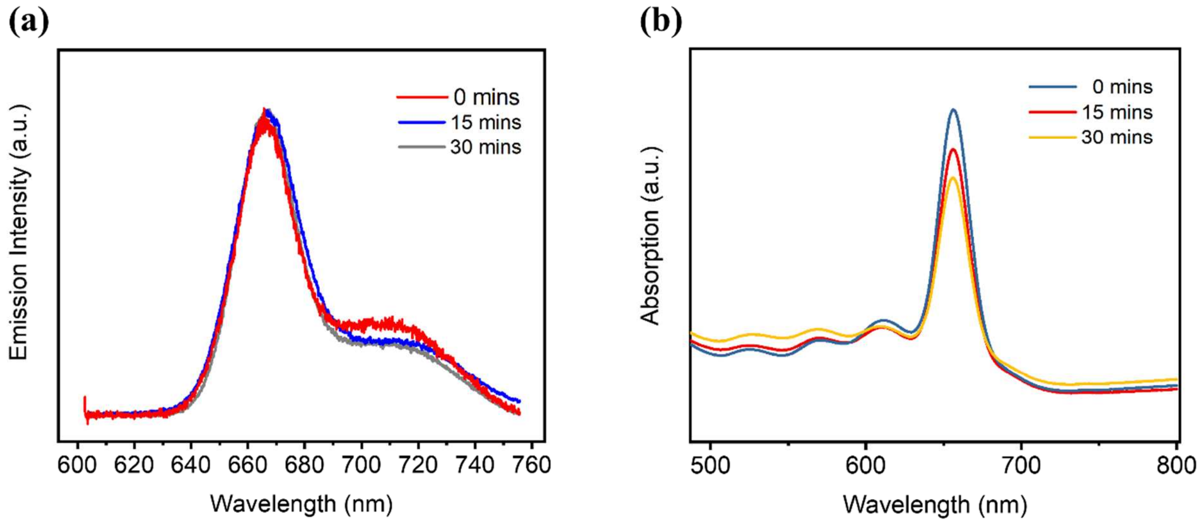

Figure S6. (a)The photoluminescence spectrum of chlorophyll a solution for 0, 15, and 30 minutes duration (b)The absorption spectrum of chlorophyll a solution under continuous excitation with 656 nm laser for 0, 15, and 30 minutes duration.

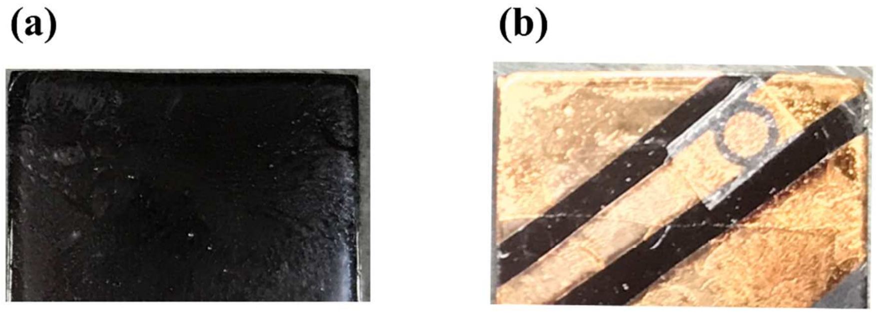

Figure S7. (a) PVA material was spin-coated on SiO_2 substrate. (b) The final device after transferring graphene and depositing chlorophyll.

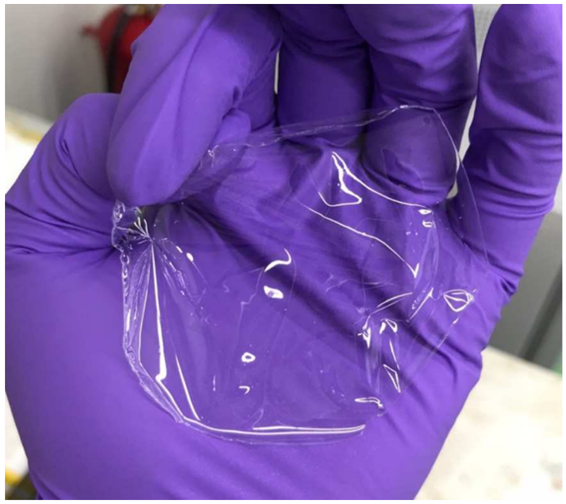

Figure S8. A transparent PVA film peeled from the petri dish is a flexible film, which can be placed on freeform surfaces.

Chlorophyll Thickness Optimization

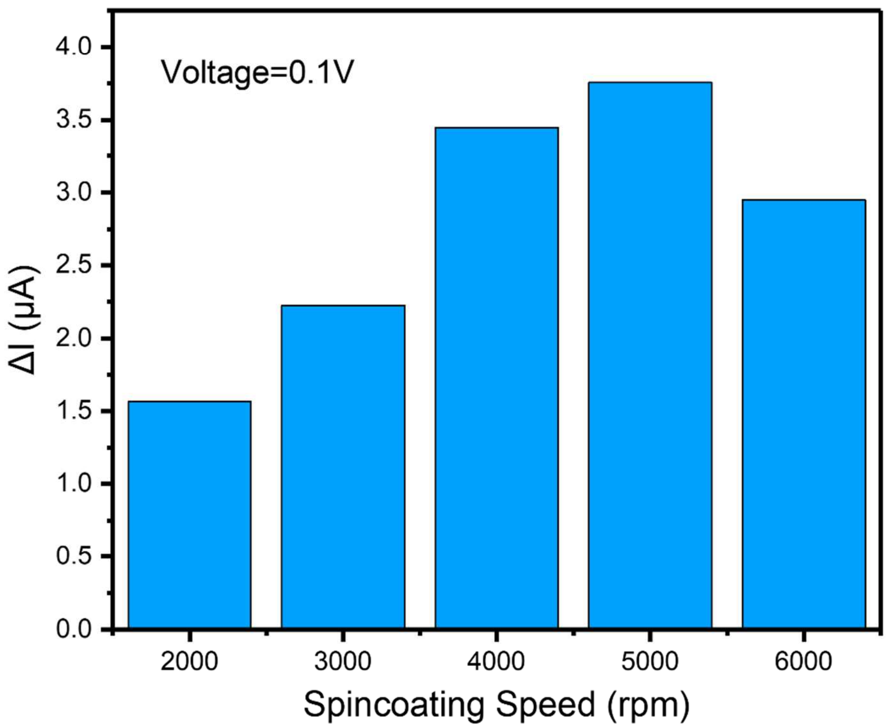

Figure S9. Dependence of photocurrent change on chlorophyll thickness for photodetector device.

To get the highest photocurrent, we optimize the thickness of chlorophyll layer. Increasing the amount of chlorophyll can increase electron-hole pairs in chlorophyll and make more carriers transferring. However, if the thickness of chlorophyll layer higher than carrier diffusion length, it is difficult to transfer carriers from chlorophyll to graphene and decrease the photocurrent. We spin-coat chlorophyll solution on devices with different spinning speed (2000 rpm - 6000 rpm) and found that the spin-coated device with the speed of 5000 rpm has the greatest photocurrent as shown in Figure S9.

Table S1. A comparison of biocompatible graphene-based photodetectors.

Components	Responsivity (A/W)	Response Time (s)	Bias (V)	Wavelength (nm)	Reference
ZnO NR/RGO	22.7	–	20	325	1
ZnO QDs/Graphene	~10^4	5	0.001	325, 445	2
ZnO NR Arrays/Graphene	113	0.0007	1	365	3
ZnO/Graphene	–	2	3	365	4
C_{60}/Graphene	–	–	0.01	White light	5
Chlorophyll/Graphene/PVA	~220	0.5	0.1	656	Our work

References

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