Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supporting Information

Direct Synthesis of Flexible Graphene Glass with Macroscopic Uniformity Enabled by Copper-Foam-Assisted PECVD

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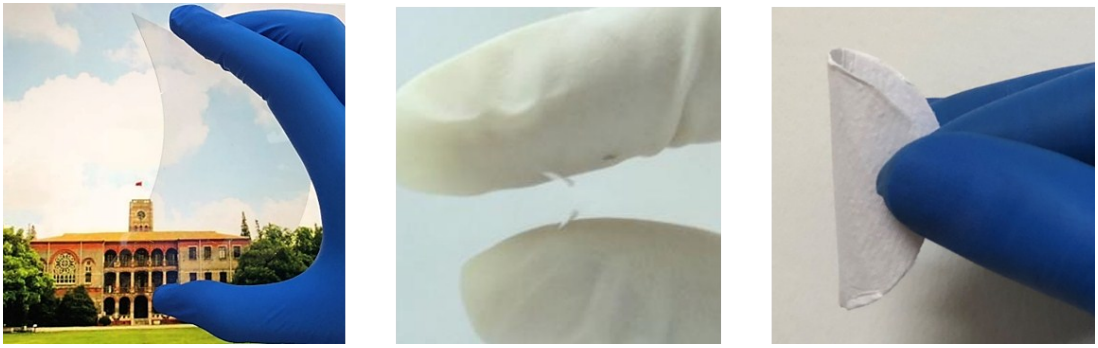

Figure S1. Photograph of the pristine flexible substrates (from left to right): flexible glass, mica sheet, glass fiber cloth.

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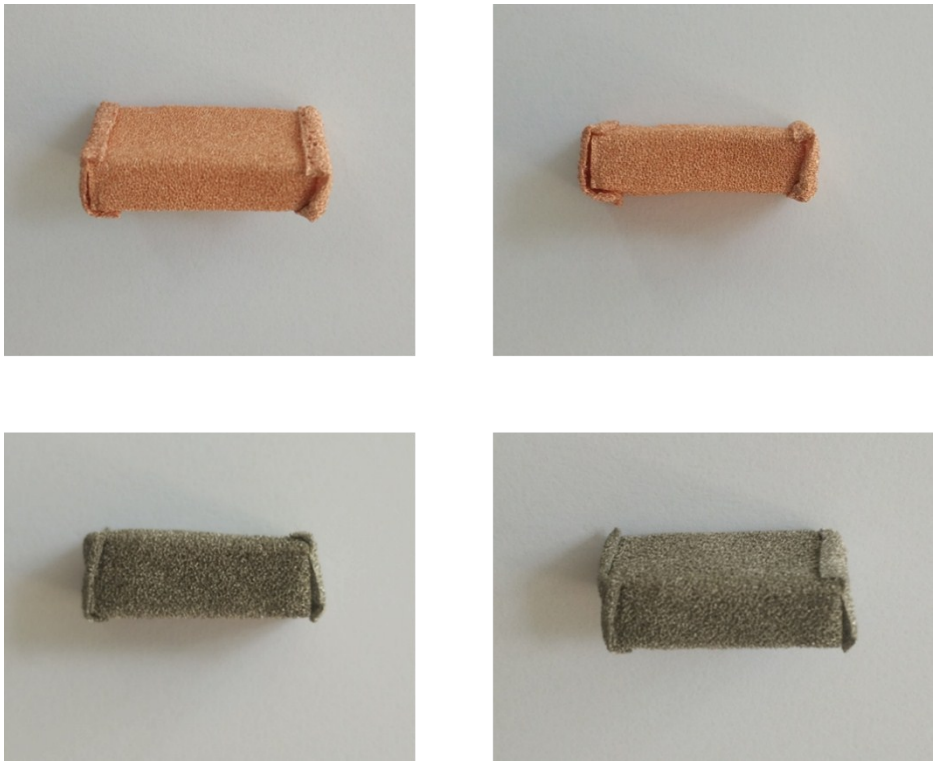

Figure S2. Photograph of typical copper-foam-cage and nickel-foam-cage with the size of 4 cm (length) × 2 cm (width) × 1 cm (height).

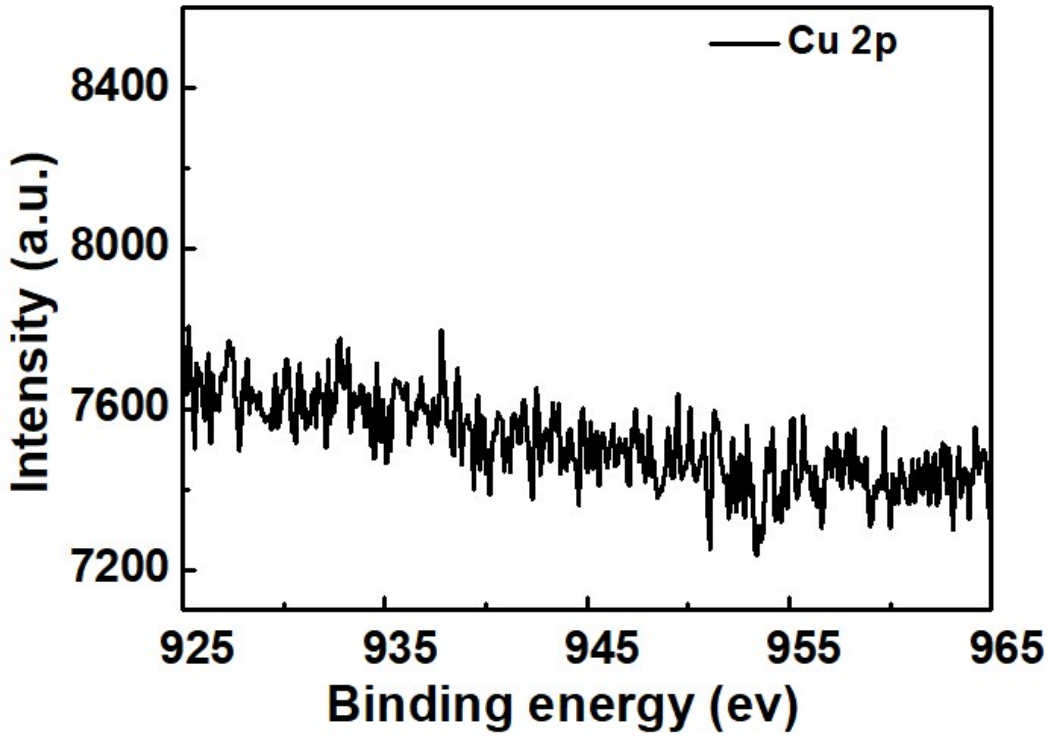

Figure S3. XPS Cu 2p spectrum of as-produced graphene glass after copper-foam-assisted PECVD reaction, showing the absence of Cu species.

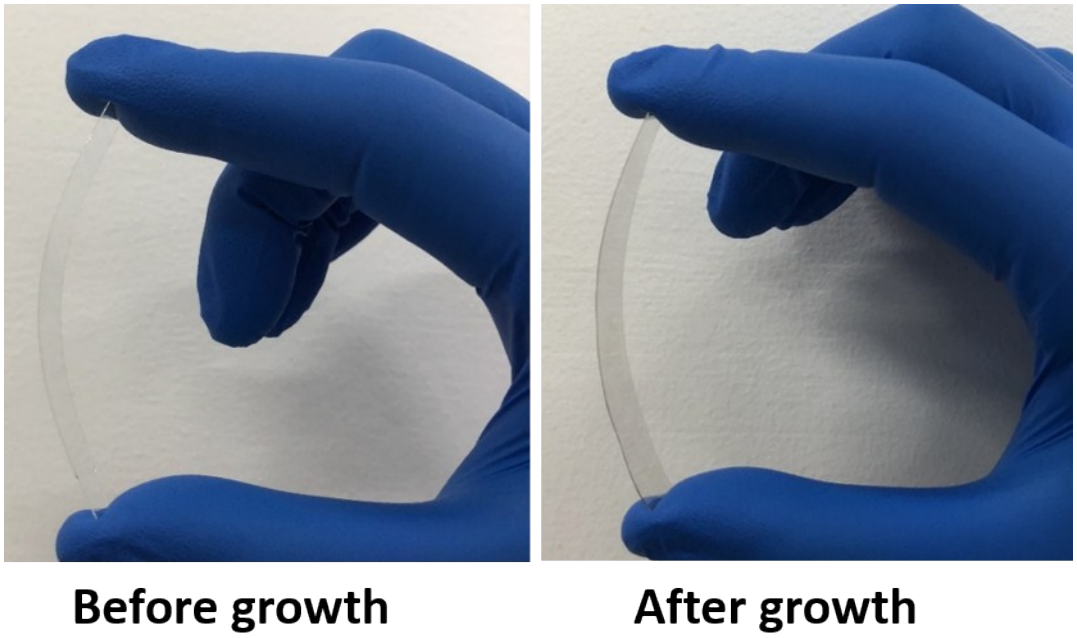

Figure S4. Photograph showing the flexible glass substrate (left) and flexible graphene glass (right). The growth condition was: 550 ^{o}C; 100 sccm Ar, 30 sccm H_2, 10 sccm CH_4; 80 W for 60 min.

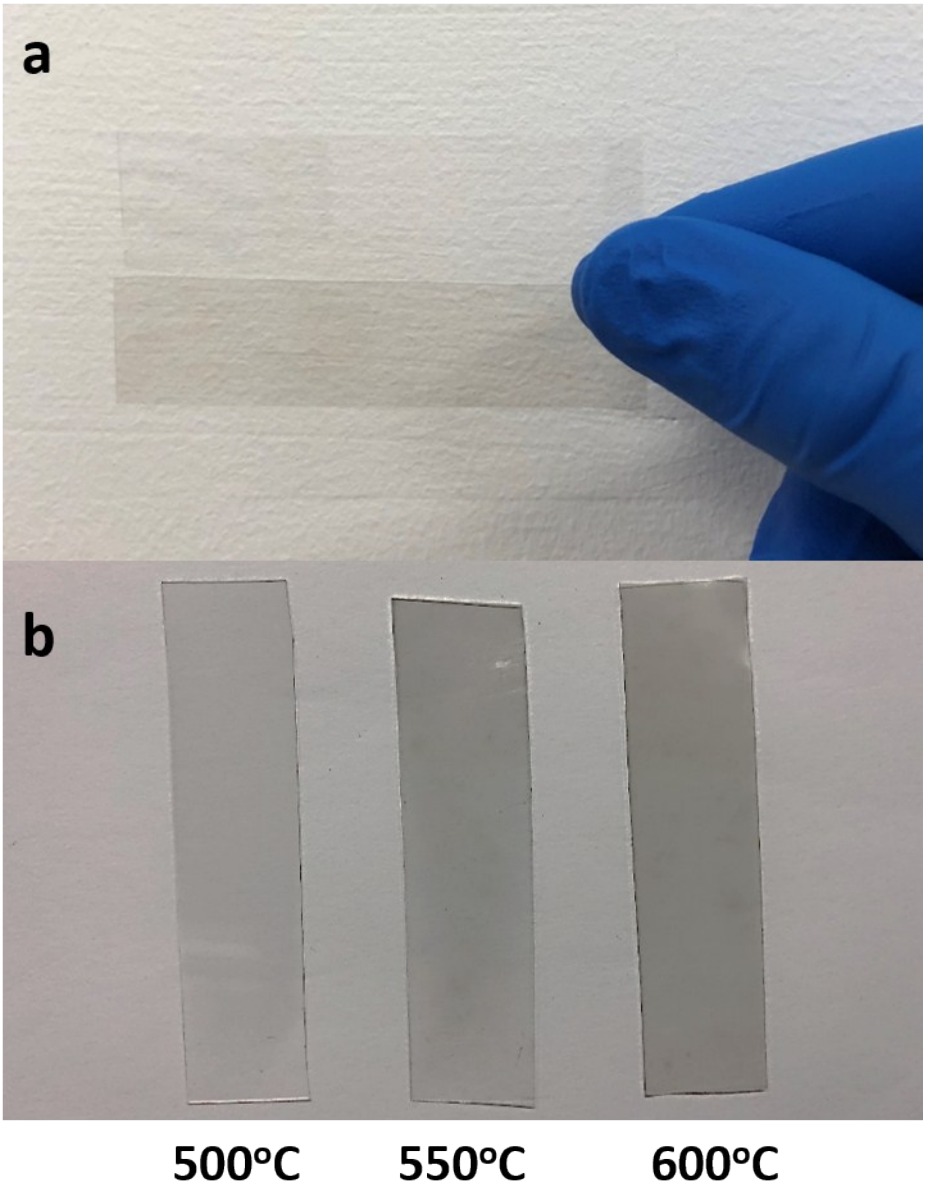

Figure S5. (a) Photograph of the as-grown flexible graphene glass (lower sample) exhibiting good uniformity as compared to bare substrate (upper sample). (b) Photograph of as-grown flexible graphene glass samples (1 cm × 5 cm) obtained at a growth temperature of 500 ^{o}C, 550 ^{o}C, and 600 ^{o}C, respectively (Growth condition: Ar:H_2:CH_4 at a flow rate of 100:30:10 sccm, growth duration of 60 min, radio frequency at 80 W).

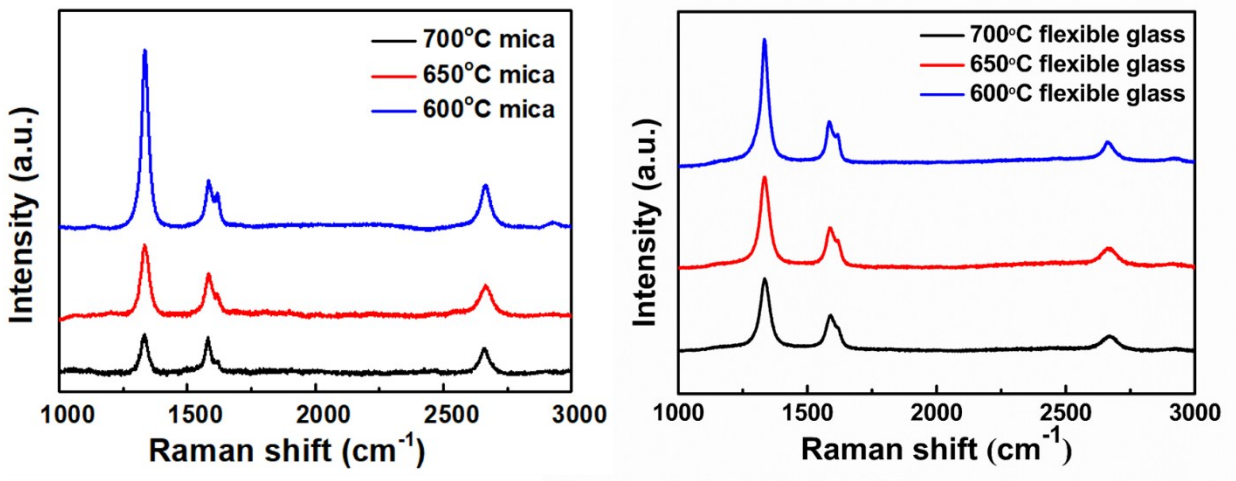

Figure S6. Raman spectra of graphene directly grown on mica and flexible glass substrates under different growth temperatures.

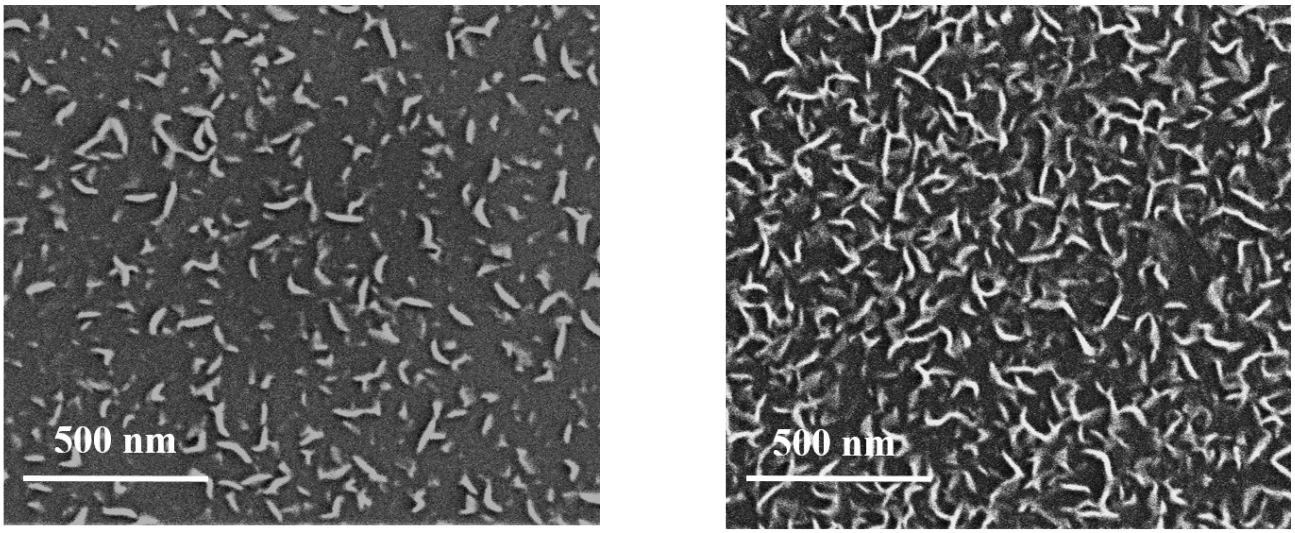

Figure S7. SEM images of directly-grown graphene *via* nickel-foam-assisted (left panel) and copper-foam-assisted (right panel) PECVD approach. Note that the other growth parameters were kept identical (650 ^{o}C; 100 sccm Ar, 30 sccm H_2, 10 sccm CH_4; 80 W for 60 min).

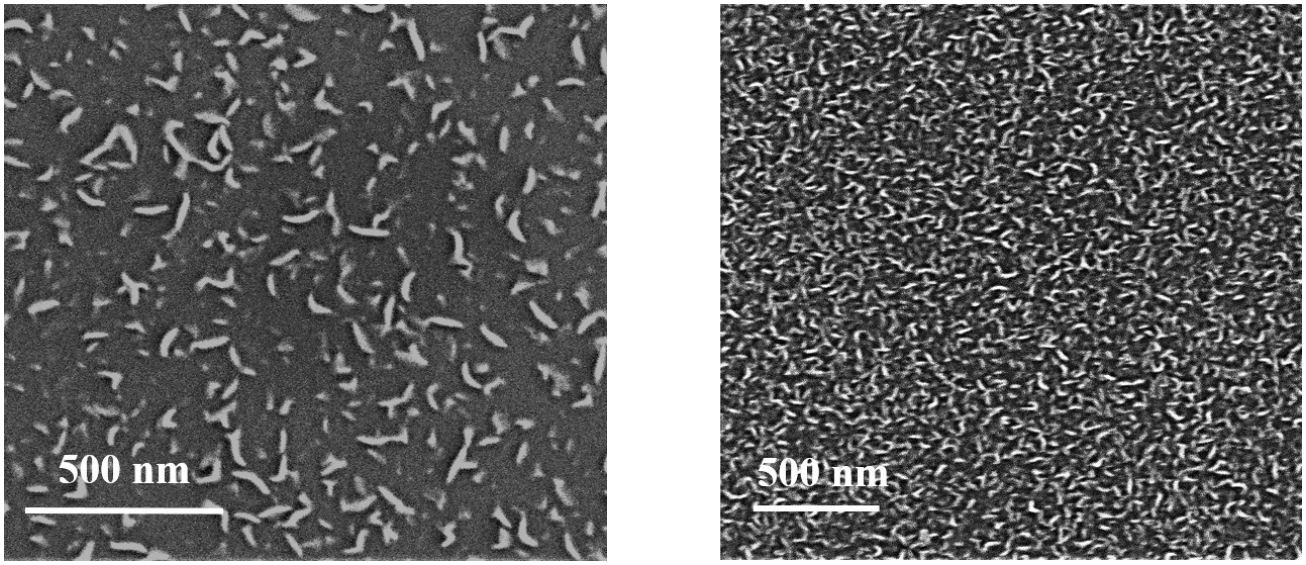

Figure S8. SEM images of directly-grown graphene *via* copper-foam-assisted PECVD at different growth durations (60 min for left panel and 120 min for right panel). Note that the other growth parameters were kept identical (650 ^{o}C; 100 sccm Ar, 30 sccm H_2, 10 sccm CH_4; 80 W).

Figure S9. Photograph of mica-based graphene glass grown via PECVD without (left column) and with (right column) the copper foam assistance. The growth conditions for each row were kept identical (700 ^{o}C; 100 sccm Ar, 30 sccm H_2, 10 sccm CH_4; growth duration of 60 min, 120 min, and 180 min).

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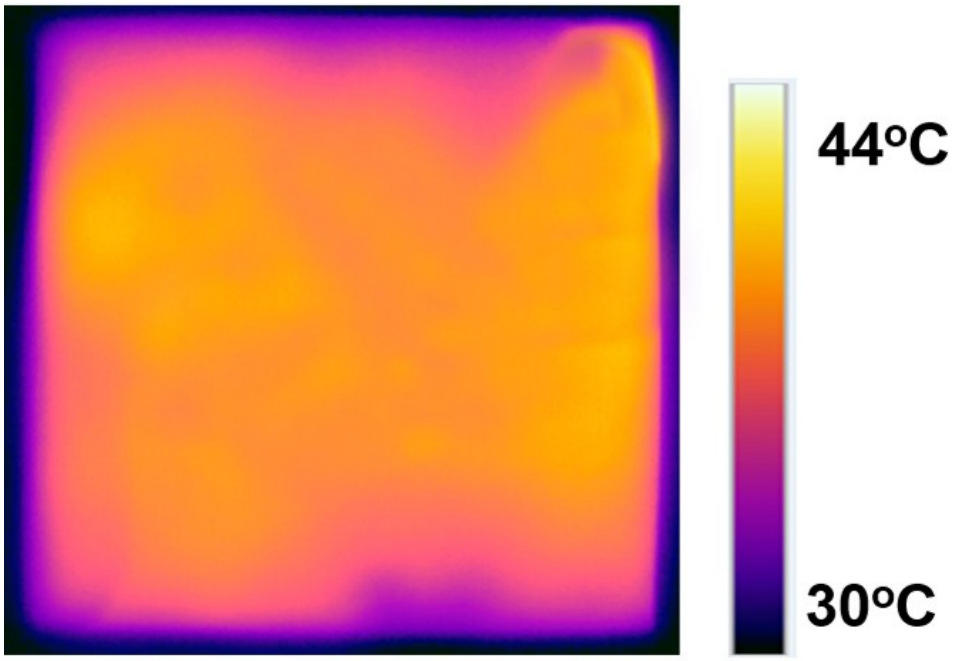

Figure S10. Surface temperature mapping of flexible graphene glass (10 cm × 10 cm) upon light exposure for 100 s.

Figure S11. Direct integration of as-produced flexible graphene glass as a conductive electrode (flat state) toward lighting up the LED indicator.

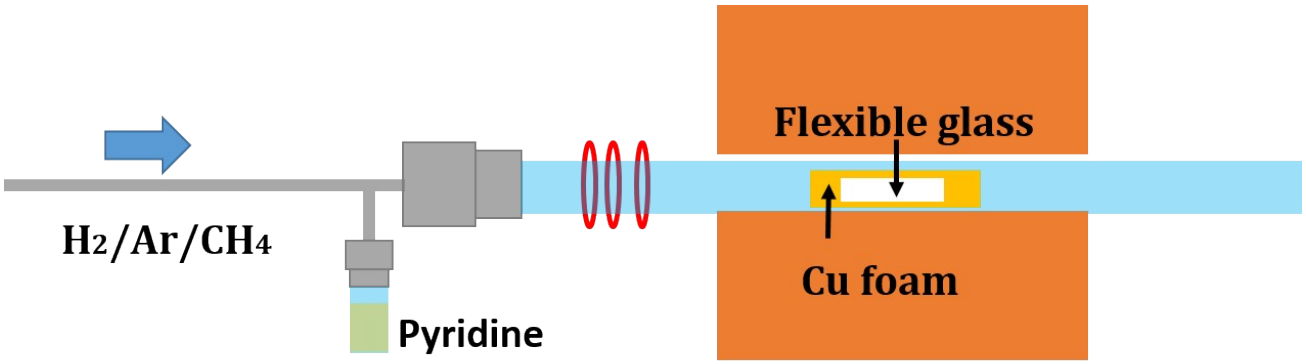

Figure S12. Schematic set-up of PECVD apparatus for the growth of N-doped graphene glass.

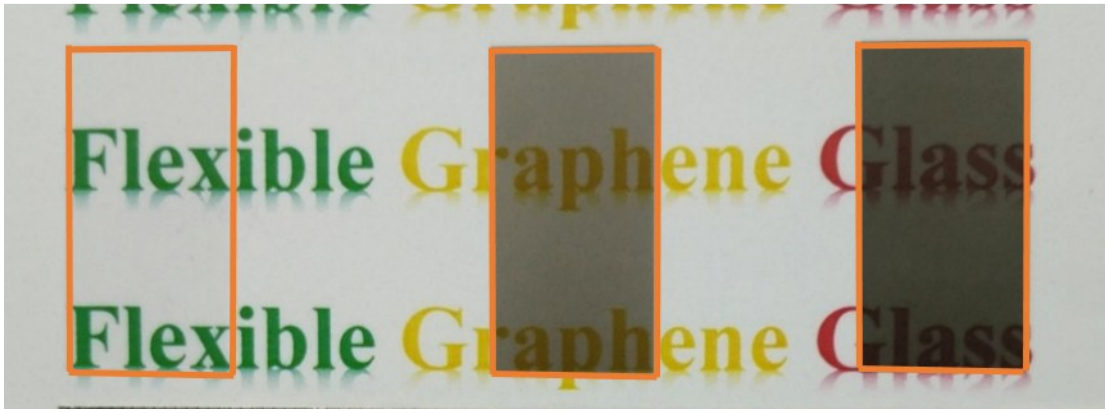

Figure S13. Photograph of as-grown N-doped graphene glass samples (3.0 cm × 1.5 cm) obtained for growth time of 60 min and 120 min with a bare flexible glass substrate (leftmost) shown for comparison.

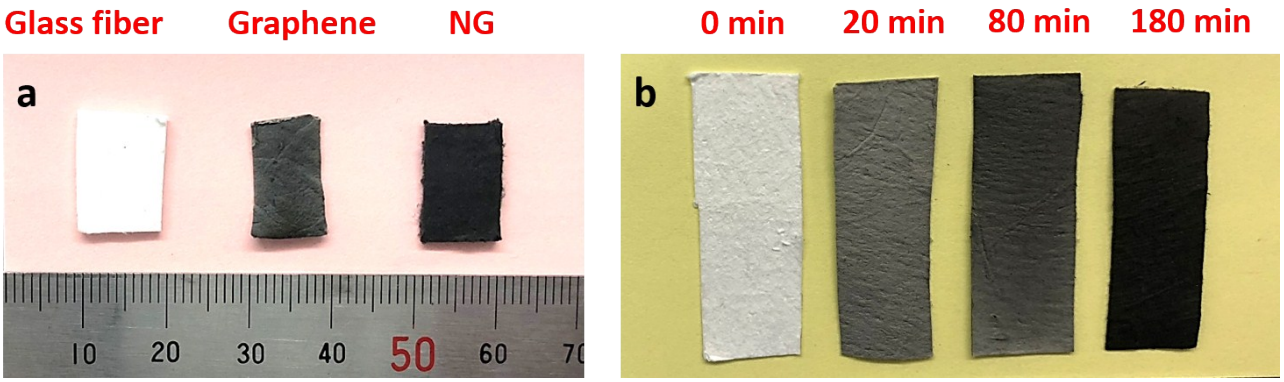

Figure S14. (a) Photograph of the pure flexible glass fiber cloth (left), graphene glass fiber cloth (center), and N-doped graphene glass fiber. (b) Photograph of as-grown flexible graphene glass fiber cloth samples obtained from different growth durations, with a bare glass fiber cloth (leftmost) displayed for comparison.

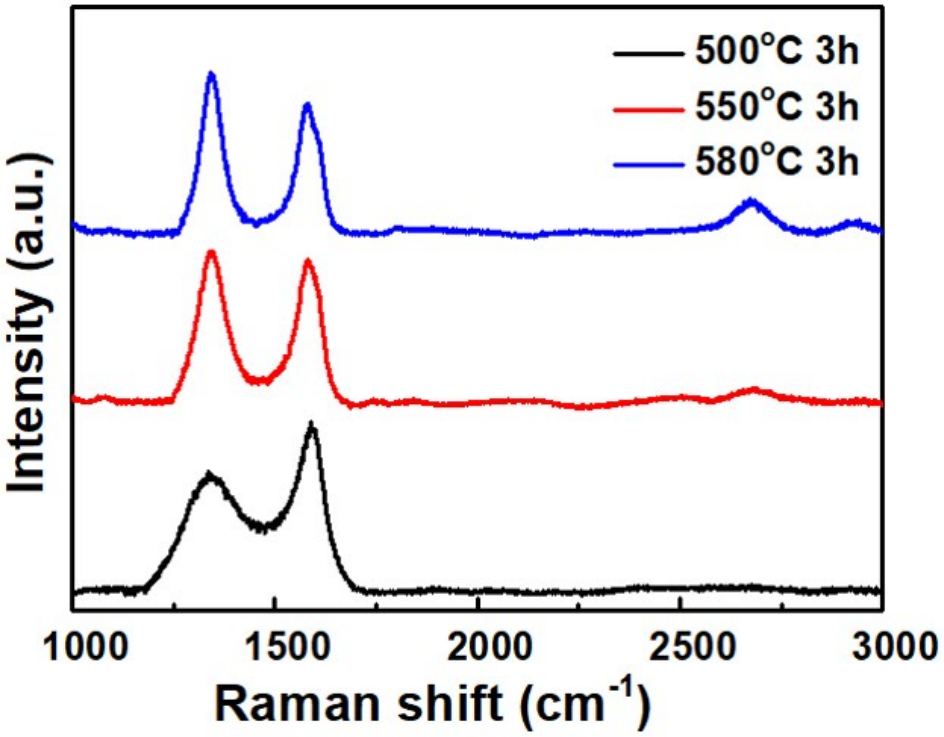

Figure S15. Representative Raman spectra obtained from flexible N-doped glass fiber cloth samples grown at 500 °C, 550 °C, and 580 °C, respectively.

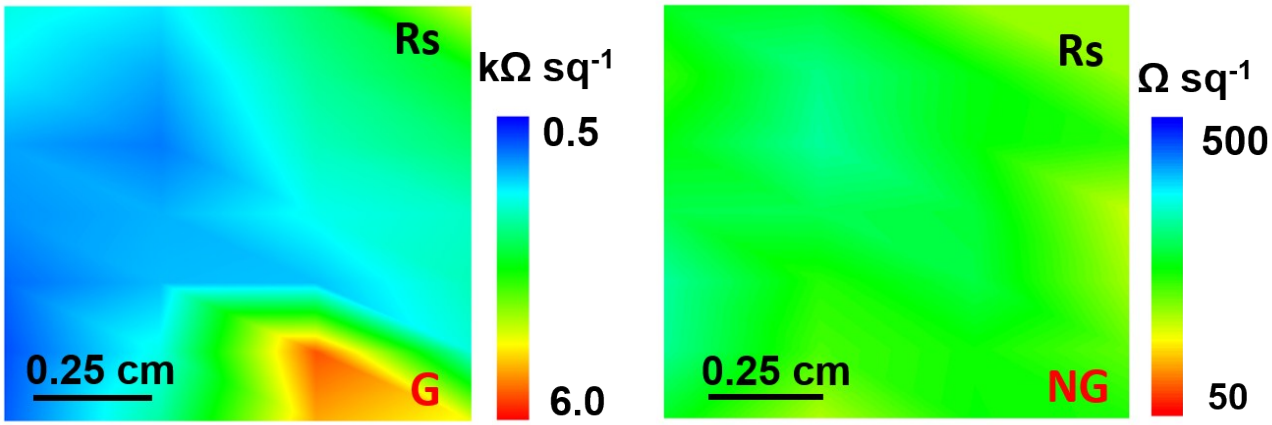

Figure S16. Spatial distribution of the sheet resistance of graphene and N-doped graphene film grown on flexible glass fiber cloth substrates.

Table S1. Comparison of synthetic routes and other information for graphene glass reported between this work and other studies.

Authors	**Synthetic routes**	**Tr% (at 550 nm)**	**R_s (Ω sq^{-1})**	**Growth temperature (^{o}C)**	**Ref.**
J. Sun et al.	CVD	82%	370-510	1050	*ACS Nano* **2016**, 10, 11136
J. Sun et al.	CVD	81%	1750-2350	1050	*Nano Lett.* **2015**, 15, 5846.
J. Sun et al.	PECVD	84.6%	5200	600	*Nano Res*. **2015**, 8, 3496.
X. Chen et al.	Ethanol-based CVD	83.5%	1300	1100-1200	*Adv. Mater.* **2017**, 29, 1603428.
H. Ci et al.	PECVD	82.9%	10900	580	*Nano Res.* **2018**, 11, 3106
Y. Qi et al.	PECVD	81.9%	4100	580	*Adv. Mater.* **2018**, 1704839
N. Wei et al.	Cu-foam-assisted PECVD	85.7%	3600	650	This work