Supporting Information

Blown Bubble Assembly of Graphene Oxide Patches for Transparent Electrodes in Carbon-Silicon Solar Cells

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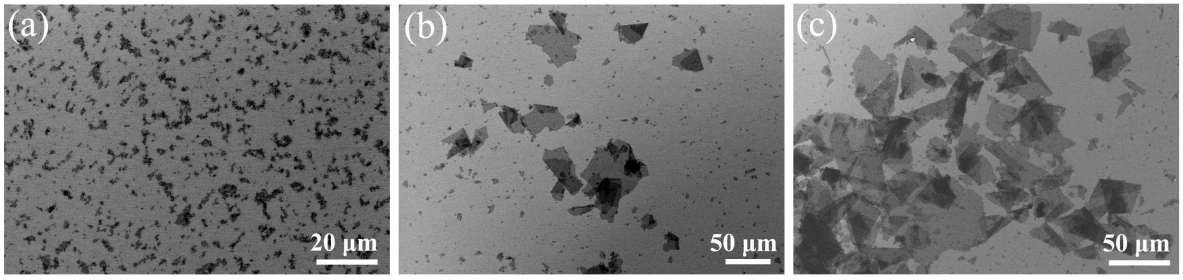

Figure S1. **Blown bubble assembly of GO sheets by water bubbles.** (a-c) SEM images of GO sheets assembled from water bubble solution with GO concentration of 0.324, 0.648 and 0.972 mg/mL, respectively. Considerable aggregations at different GO concentrations can be observed and the sheets tended to break into smaller size.

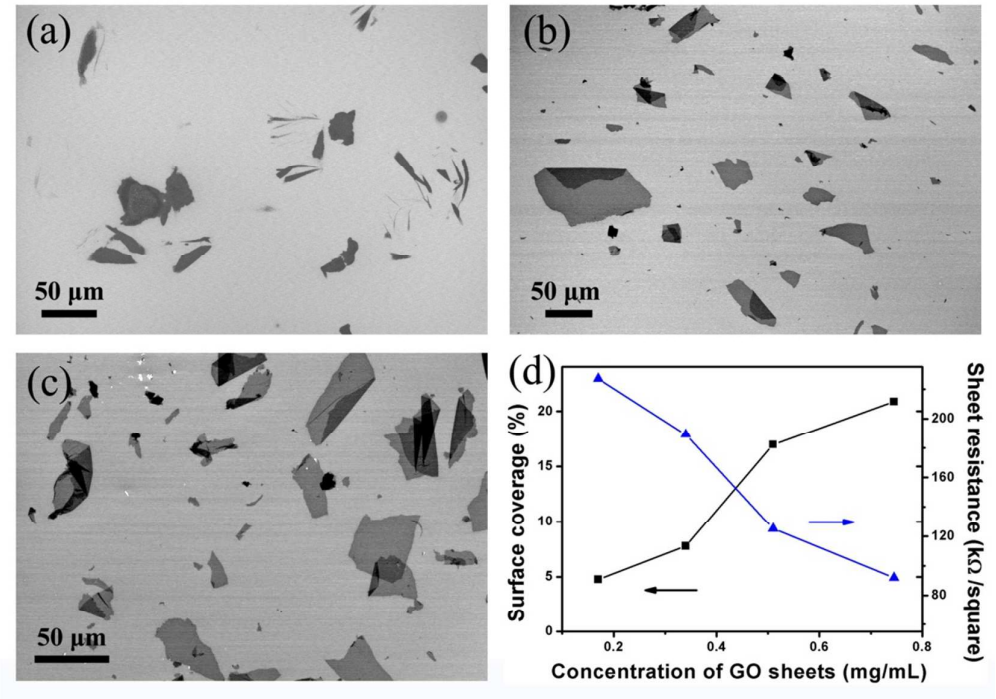

Figure S2. **Assembled GO sheets with different density.** (a-c) SEM images of assembled GO sheets with initial GO concentrations in the bubble solution of 0.17, 0.34 and 0.51 mg/mL, respectively. (d) The surface coverage of the RGO sheets and the sheet resistance of the hybrid film changing with the GO concentration.

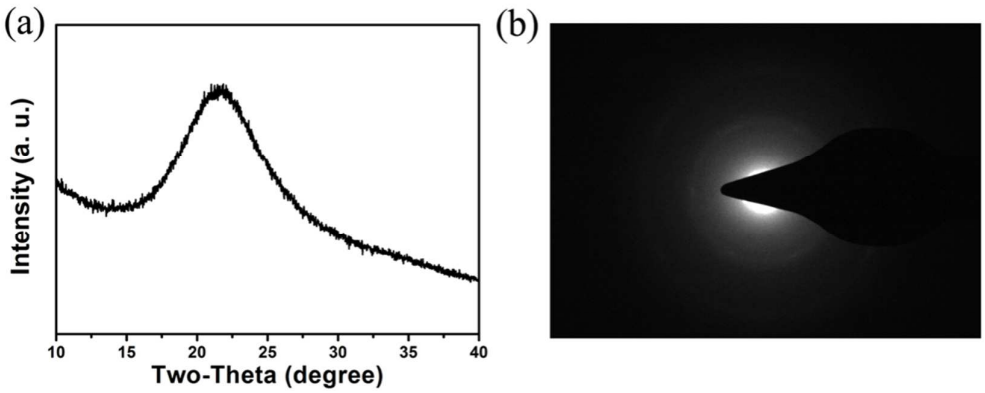

Figure S3. **Characterization of the carbon film.** (a) X-ray diffraction of the carbon film. (b) Transmission electron diffraction patterns of the carbon film.

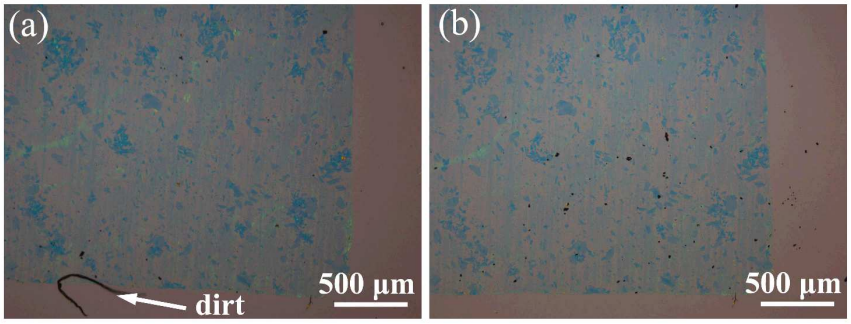

Figure S4. **Optical microscopic images of the RGO-carbon hybrid film transferred to Si wafer before (a) and after (b) ultrasonication for 2 min.** The location of RGO patches was unchanged and the dirt on the substrate was taken away.

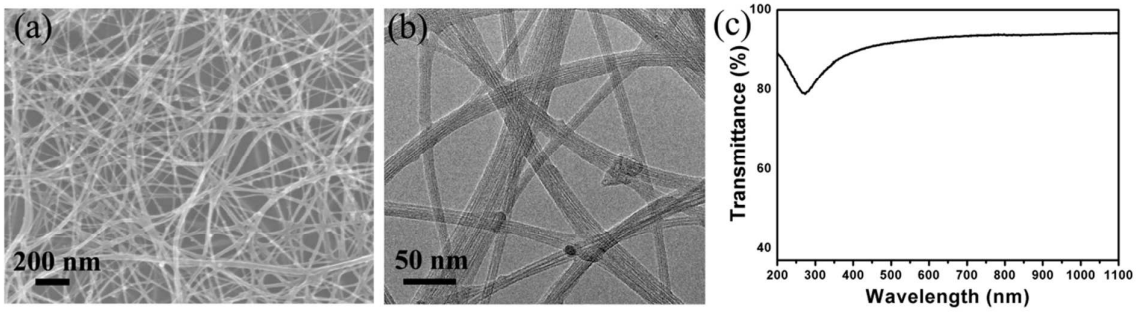

Figure S5. **Characterization of the SWNT film.** (a) SEM image, (b) TEM image and (c) optical transmittance of the SWNT film. The SWNT film is a kind of flexible film with sheet resistance of a few hundred Ω per square. The optical transparency of the SWNT film is more than 90% at 550 nm, and the diameters of the SWNTs and bundles are about several to tens of nanometers.

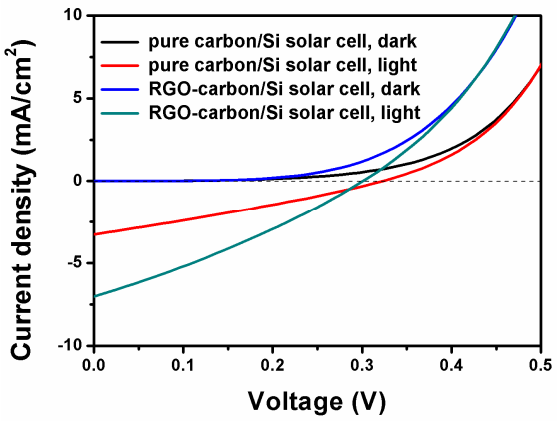

Figure S6. Comparison of the *J*-V curves of the pure carbon/n-Si and RGO-carbon/n-Si solar cells.

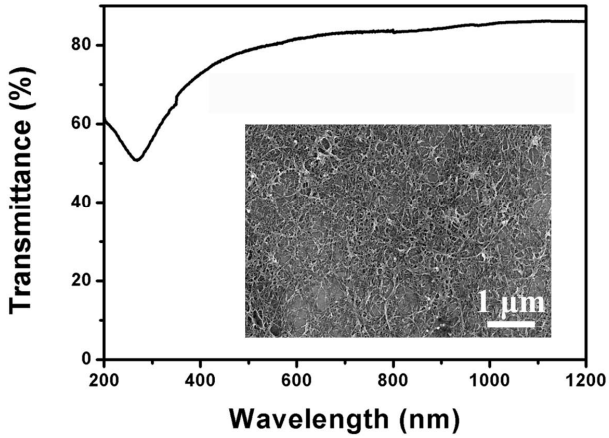

Figure S7. Optical transmittance of the RGO-carbon hybrid film covered by SWNT film. Inset, enlarged view of the covered SWNT film.

Table S1 Comparison of the performance of SWNT/Si solar cells and SWNT film/RGO-carbon /n-Si cells.

	SWNT film/RGO-carbon/n-Si cell				SWNT/n-Si cell[1]			
	V_{oc} (V)	J_{sc} (mA/cm^2)	FF (%)	η (%)	V_{oc} (V)	J_{sc} (mA/cm^2)	FF (%)	η (%)
original	0.488	21.33	61.7	6.42	0.61	32.0	77.0	15.1
6 days later	0.447	20.44	37.76	3.45	0.52	32.0	48.7	8.14
Decrement (%)	8.40	4.17	38.80	46.26	14.75	0	37.01	46.1

Table S2 Comparison of the stability of the solar cell parameters for RGO-carbon/n-Si and SWNT film/RGO-carbon/n-Si cells

	SWNT film/RGO-carbon/n-Si cell				RGO-carbon/n-Si cell			
	V_{oc} (V)	J_{sc} (mA/cm^2)	FF (%)	η (%)	V_{oc} (V)	J_{sc} (mA/cm^2)	FF (%)	η (%)
original	0.488	21.33	61.7	6.42	0.498	14.47	32.22	2.32
10 days later	0.438	20.37	34.66	3.09	0.417	8.68	23.84	0.86
Decrement (%)	10.25	4.50	43.82	51.87	16.26	40.01	26.00	62.93

Reference

1. Shi, E. Z.; Zhang, L. H.; Li, Z.; Li, P. X.; Shang, Y. Y.; Jia, Y.; Wei, J. Q.; Wang, K. L.; Zhu, H. W.; Wu, D. H.; Zhang, S.; Cao, A. Y. TiO_2-Coated Carbon Nanotube-Silicon Solar Cells with Efficiency of 15%. *Sci. Rep.* **2012**, 2, 884-888.