

Table S1. Photovoltaic parameters of each device with different nanotube diameters.

| Device | Nanotube Diameter (nm) | V _{oc} (V) | J _{sc} (mA/cm ²) | FF (%) | PCE (%) |
|--------|------------------------|---------------------|---------------------------------------|--------|---------|
| 1 | 100 | 0.57 | 4.76 | 49.1 | 1.34 |
| | | 0.53 | 4.97 | 49.9 | 1.32 |
| | | 0.52 | 5.04 | 49.7 | 1.31 |
| | | 0.57 | 4.83 | 49.8 | 1.38 |
| | | 0.53 | 4.84 | 48.8 | 1.26 |
| | | 0.54 | 4.81 | 49.5 | 1.29 |
| | | 0.57 | 4.96 | 49.1 | 1.39 |
| | | 0.56 | 5.04 | 50.5 | 1.43 |
| | | 0.54 | 5.03 | 48.7 | 1.33 |
| | | 0.54 | 4.94 | 50.2 | 1.34 |
| 2 | 80 | 0.51 | 5.47 | 48.5 | 1.36 |
| | | 0.53 | 5.43 | 49.6 | 1.43 |
| | | 0.54 | 5.50 | 49.4 | 1.47 |
| | | 0.51 | 5.43 | 49.1 | 1.36 |
| | | 0.54 | 5.32 | 49.7 | 1.43 |
| | | 0.55 | 5.35 | 49.1 | 1.44 |
| | | 0.55 | 5.44 | 49.6 | 1.48 |
| | | 0.54 | 5.18 | 48.4 | 1.36 |
| | | 0.51 | 5.62 | 48.3 | 1.39 |
| | | 0.54 | 5.44 | 48.2 | 1.41 |
| 3 | 60 | 0.51 | 4.41 | 48.4 | 1.09 |
| | | 0.56 | 4.45 | 47.9 | 1.19 |
| | | 0.53 | 4.52 | 48.0 | 1.15 |
| | | 0.53 | 4.59 | 48.2 | 1.17 |
| | | 0.53 | 4.59 | 49.5 | 1.20 |
| | | 0.56 | 4.29 | 48.1 | 1.16 |
| | | 0.51 | 4.38 | 48.2 | 1.08 |
| | | 0.56 | 4.53 | 47.2 | 1.19 |
| | | 0.54 | 4.57 | 49.1 | 1.21 |
| | | 0.56 | 4.46 | 48.7 | 1.22 |
| 4 | 40 | 0.53 | 3.68 | 49.1 | 0.95 |
| | | 0.53 | 3.75 | 47.5 | 0.94 |
| | | 0.51 | 3.61 | 48.5 | 0.89 |
| | | 0.54 | 3.51 | 49.0 | 0.92 |
| | | 0.53 | 3.61 | 49.2 | 0.94 |
| | | 0.53 | 3.50 | 47.5 | 0.88 |
| | | 0.51 | 3.56 | 48.8 | 0.89 |
| | | 0.53 | 3.47 | 48.7 | 0.90 |
| | | 0.51 | 3.48 | 48.0 | 0.86 |
| | | 0.48 | 3.44 | 48.8 | 0.81 |
| 5 | planar | 0.88 | 0.92 | 59.7 | 0.48 |
| | | 0.93 | 0.64 | 61.2 | 0.37 |
| | | 0.9 | 0.65 | 60.3 | 0.36 |
| | | 0.89 | 0.84 | 59.2 | 0.44 |
| | | 0.87 | 0.84 | 60.2 | 0.44 |

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| | 0.91 | 0.70 | 60.4 | 0.39 |
| | 0.91 | 0.70 | 59.8 | 0.39 |
| | 0.93 | 0.83 | 59.9 | 0.46 |
| | 0.89 | 0.71 | 60.3 | 0.39 |
| | 0.91 | 0.91 | 59.1 | 0.49 |