

Highly efficient graphene-based Cu(In, Ga)Se₂ solar cells with large active area

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Electronic Supplementary Information:

1. **Table 1S: Summary of the efficiencies of graphene-based solar cells**
2. **Figure 1S: Optical image of Ni/Al/Ni grids deposited by evaporation.**
3. **Figure 2S: J-V curves of graphene-based CIGS solar cells with 1-layer graphene and 4-layer graphene**
4. **Figure 3S: PCE of reference CIGS and graphene-based CIGS solar cells as a function of exposure time under ambient conditions**

1. Table 1S: Summary of the efficiencies of graphene-based solar cells

| Type of solar cell | PCE | Area (mm ²) | Graphene-based materials | University | Year | Journal published | Ref |
|---|-------|-------------------------|---------------------------|---------------------------------------|------|-------------------|-------|
| Thin film perovskite solar cells | 15.6% | 9.0 | Graphene/TiO ₂ | University of Oxford | 2014 | Nano Lett. | [1,2] |
| Graphene/n-Si Schottky junction solar cells | 14.5% | 4.747 | Graphene/TiO ₂ | Peking University | 2013 | Nano Lett. | [3] |
| Thin film CIGS solar cell | 13.5% | 45.0 | Graphene/PMMA | The Chinese University of Hong Kong | 2014 | Our result | |
| Graphene/n-Si Schottky junction solar cells | 10.6% | 14.5 | Graphene/TiO ₂ | Peking University | 2013 | Nano Lett. | [3] |
| Graphene/n-Si Schottky junction solar cells | 8.6% | 9.0 | Graphene | University of Florida | 2012 | Nano Lett. | [4] |
| Thin film CdTe solar cell | 4.7% | N/A | Graphene | Chinese Academy of Sciences | 2011 | Adv.Mater | [5] |
| Hybrid Solar Cells | 4.2% | 1.21 | Graphene | Massachusetts Institute of Technology | 2012 | Nano Lett. | [6] |
| Semitransparent Organic Solar Cells | 2.7% | 20.0 | Graphene | The Hong Kong Polytechnic University | 2012 | ACS Nano | [7] |
| Organic Solar Cells | 2.5% | 4.0 | Graphene | National University of Singapore | 2011 | Adv. Mater | [8] |
| Organic Solar Cells | 0.85% | N/A | Graphene | Massachusetts Institute of Technology | 2012 | Nano Lett. | [9] |

2. Figure 1S

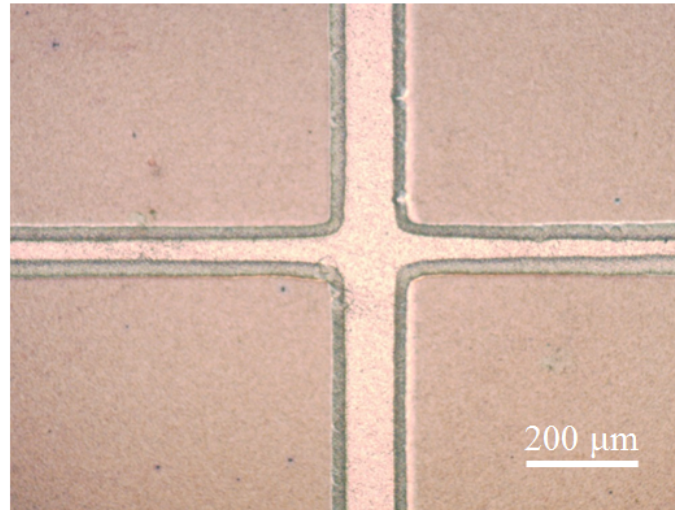


Figure 1S. Optical image of Ni/Al/Ni grids deposited by evaporation.

3. Figure 2S:

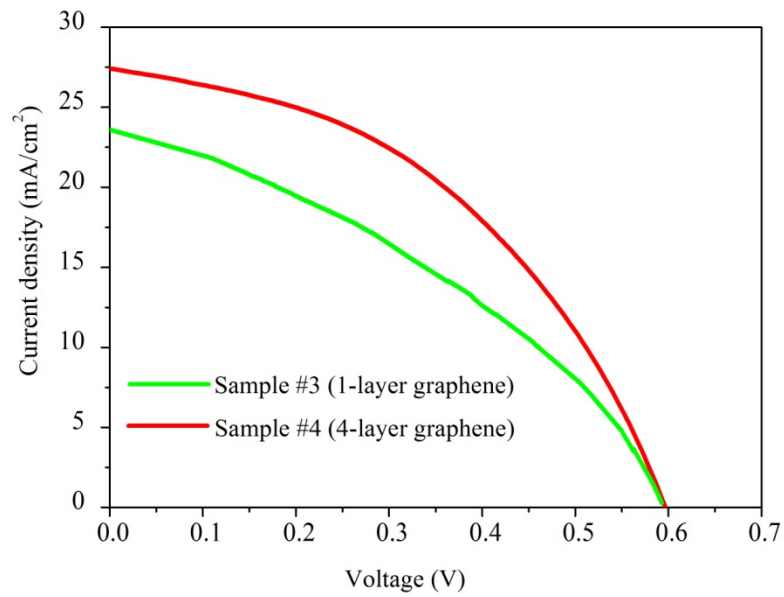


Figure 2S. J-V curves of graphene-based CIGS solar cells with 1-layer graphene and 4-layer graphene conducting electrode under AM1.5 illumination.

4. Figure 3S:

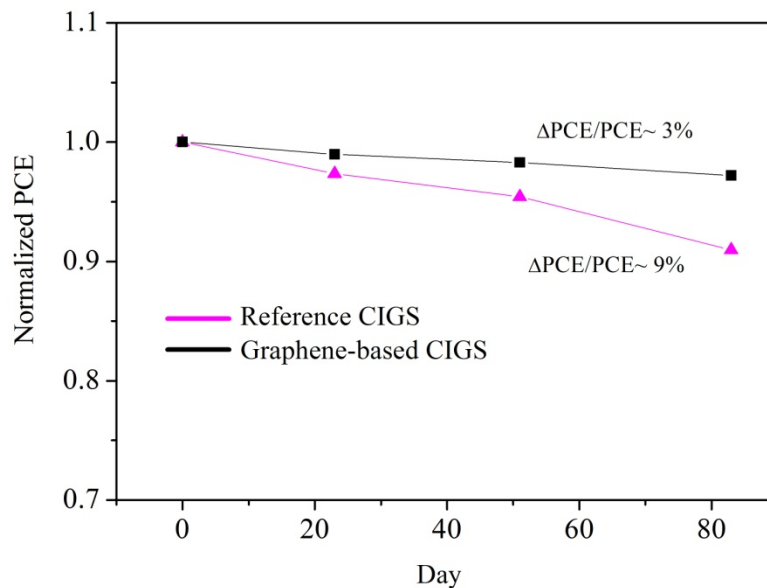


Figure 3S. PCE of reference CIGS and graphene-based CIGS solar cells as a function of exposure time under ambient conditions.

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