Supplementary Information

Improvement of Photovoltaic Parameters of Perovskite Solar Cells Using Reduced-Graphene-Oxide-Modified Titania Layer and Soluble Copper Phthalocyanine as Hole Transporter

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**Figure S1.** XRD patterns of: (1) T/RGO nano-powders, (2) T/0.2 RGO mesoporous film on FTO substrate and (3) perovskite film on T/0.2 RGO mesoporous film and FTO glass.
**EDX Spectra of Perovskite film**

**1st measurement**

![EDX Spectrum 1st Measurement](image1)

<table>
<thead>
<tr>
<th>Element</th>
<th>Cl</th>
<th>Sn⁺</th>
<th>I</th>
<th>Pb</th>
</tr>
</thead>
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<tr>
<td>At. %</td>
<td>20.15</td>
<td>21.25</td>
<td>40.84</td>
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**2nd measurement**

![EDX Spectrum 2nd Measurement](image2)

<table>
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<th>Cl</th>
<th>Sn⁺</th>
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<tr>
<td>At. %</td>
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<td>3.75</td>
<td>46.34</td>
<td>26.86</td>
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</table>

**Figure S2.** EDX spectra and elemental analysis of organo-lead halide perovskite film obtained by analyzing radiation at different positions. Sn comes from the FTO (Fluorine doped Tin Oxide) substrate.
Figure S3. The transmission line equivalent circuit used to fit the impedance data of mesoscopic PSCs. $R_S$ represents the resistance of conductive substrate, $C_{BL}$ the capacitance and $R_{BL}$ the charge transfer resistance at TiO$_2$ compact blocking layer, $R_t$ the transport resistance in the mesoporous/perovskite film, $R_r$ the recombination resistance accounting for losses of electrons from perovskite absorber layer, $C_μ$ the chemical capacitance, the $R_{CuBu}$ the resistance of CuBuPc as hole-transporting material.
Figure S4. FESEM images of: (a) graphene oxide sheets produced by Hummers and Offeman method and (b) TiO$_2$/reduced graphene oxide nanocomposite synthesized via an in-situ solvothermal process. The scale bar is 100 nm in (a) and 200 nm in (b).
Figure S5. (a) HRTEM image, (b) interfringe spacing graph and (c) corresponding selected area electron diffraction pattern for T/RGO nanocomposite.
Figure S6. Normalized photovoltaic parameters (a) $J_{SC}$, (b) $V_{OC}$ and (c) FF as a function of ageing time for mesoscopic PSC devices based on (1) pure TiO$_2$ and (2) T/0.2RGO mesoporous layers as electron transport mediator.