Electronic Supplementary Material (ESI) for Journal of Materials Chemistry
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Supporting Information

$NaYF_4:Er^{3+}/Yb^{3+}$-Graphene Composites: Preparation, Upconversion Luminescence, and Application in Dye-Sensitized Solar Cells

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Figure S1. EDS analysis results of (a) RGC-1, (b) RGC-2, (c) RGC-3, (d) RGC-4, and (e) RGC-5.

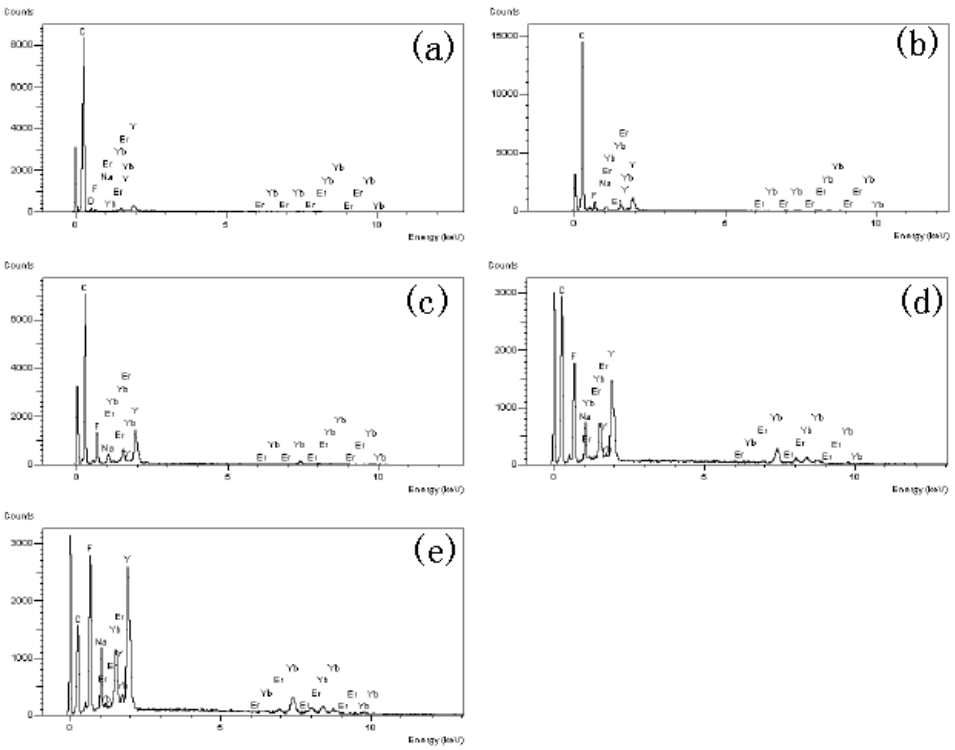

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Figure S2. TGA curves of $NaYF_4:Er^{3+}/Yb^{3+}$ and $NaYF_4:Er^{3+}/Yb^{3+}$-graphene composites.

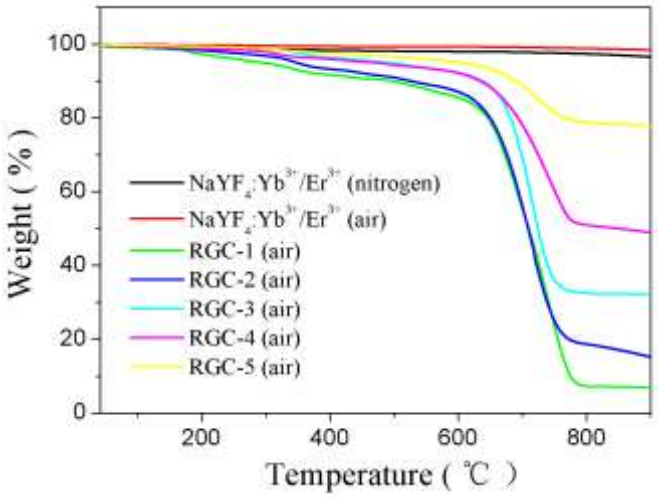

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Figure S3. Energy-level and UC schemes for the Yb^{3+}–Er^{3+} system.

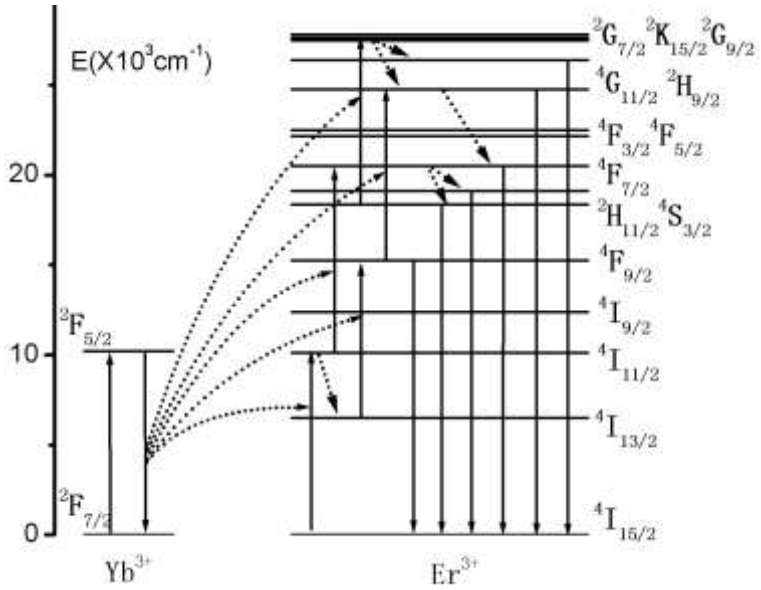

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Figure S4. Equivalent circuit used to reprsent interfaces in composite solar cells composed of FTO|TiO_2–dye|I_3^-/I^-||Pt|FTO

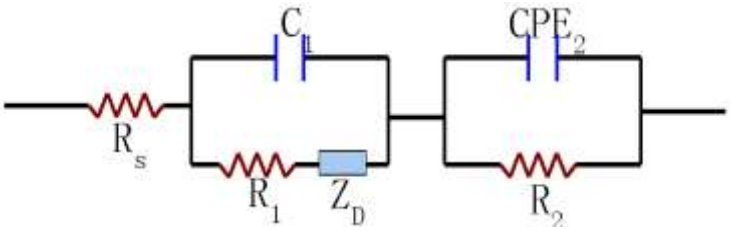

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Figure S5. Comparison of diffusion lengths of TiO_2 and TiO_2-RGC-5 photoanodes.

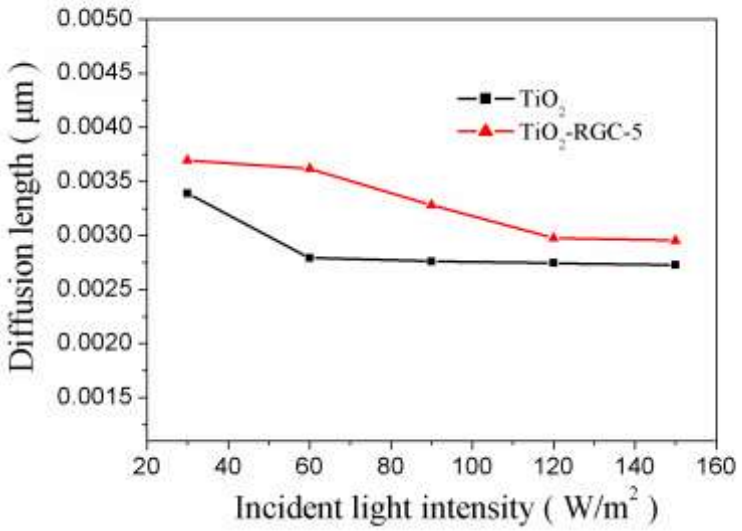

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Figure S6. Comparison of diffusion coefficients of TiO_2 and TiO_2-RGC-5 photoanodes.

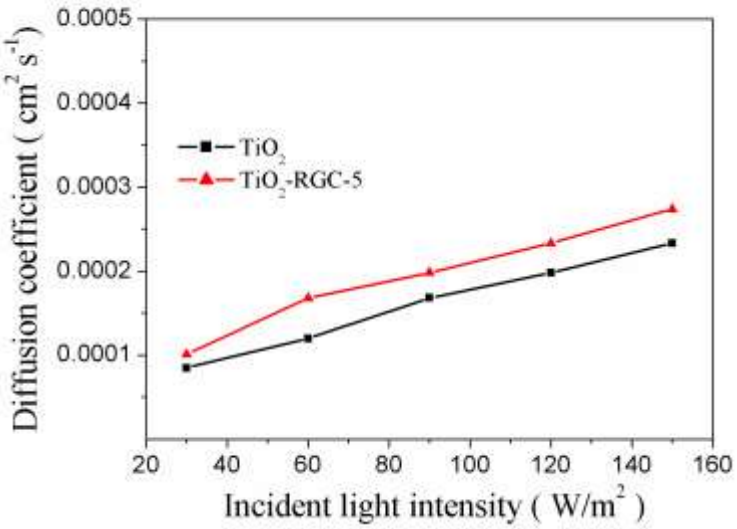

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Figure S7. Comparison of transport time constant for DSSCs as a function of applied voltage (or quasi-Fermi energy).

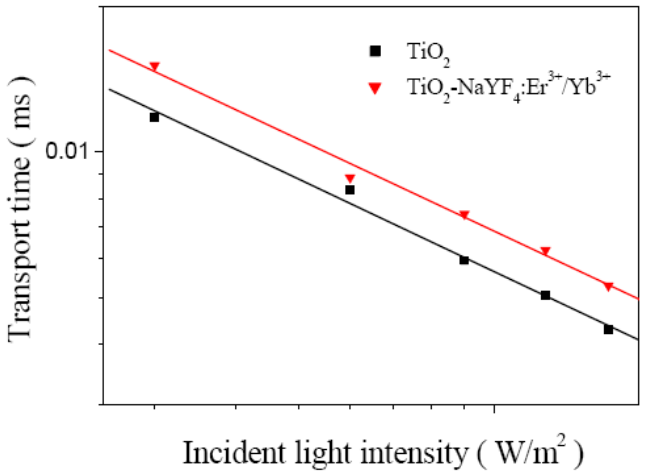

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Figure S8. Nyquist plots of DSSCs comprised of pure TiO_2 cell and TiO_2-$NaYF_4$:Yb^{3+}/Er^{3+} cell.