Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics

Supporting information

Panchromatic Porous Specular Back Reflectors for Efficient Transparent Dye Solar Cells

Carmen López-López, Silvia Colodrero, Hernán Míguez*

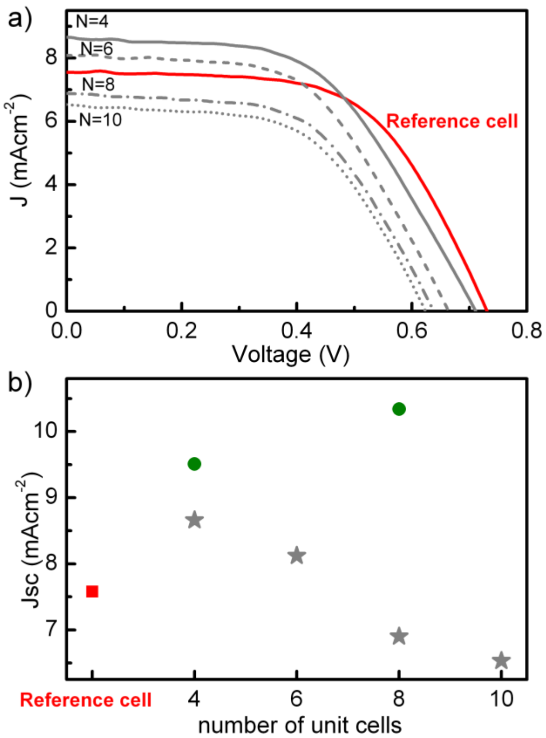


Figure S1. a) IV curves measured from a reference cell (red line) and cells integrating photonic crystal with different number of unit cells (grey lines). B) Short circuit photocurrent density (Jsc) obtained from cells in which the electrode was coupled to a non-modified low porosity 1DPCs (grey stars) and al so from highly porous 1DPCs (green circles) as a function of the number of unit cells employed. Jsc measured from a reference cell (red square) is also plotted.

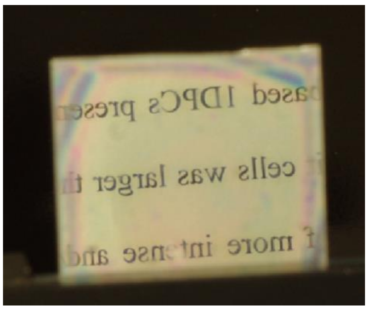
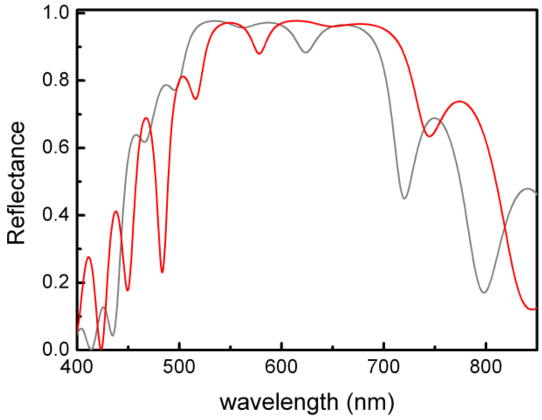
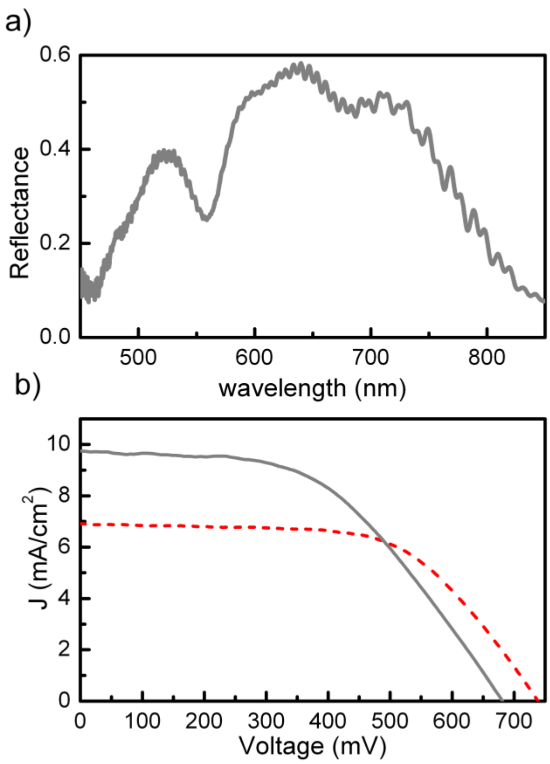


Figure S2. Picture of a white light reflecting photonic multilayer.



FigureS3. Reflectance spectra calculated from a triple period 1DPC in which the periodic lattices increase along the direction of incident light (grey line) and the opposite case (red line).



FigureS4. a) Reflectance spectra of the DSCs coupled to a triple period photonic structure infiltrated with electrolyte under rear illumination conditions, b) IV curves of this latter 1DPC based solar device and a reference cell.

Evaluation of the transparency of the Dye Solar Cells integrating photonic multilayers

Following the expression based on the methodology prescribed in ISO 9050:2003, the transparency of the different DSCs is calculated from the ballistic transmittance spectra in the wavelength range of 380 to 780 nm:

$$\tau_v = \frac{\sum_{\lambda=380}^{780} \tau_v(\lambda) D_\lambda V(\lambda) \Delta\lambda}{\sum_{\lambda=380}^{780} D_\lambda V(\lambda) \Delta\lambda}$$

, where $V(\lambda)$ is the photopic spectral luminous efficiency function that describes the average spectral sensitivity of human visual perception (ISO/CIE 10527), D_λ corresponds to the AM1.5 solar spectral irradiance and $\tau_v(\lambda)$ is the spectral transmittance of the sample.

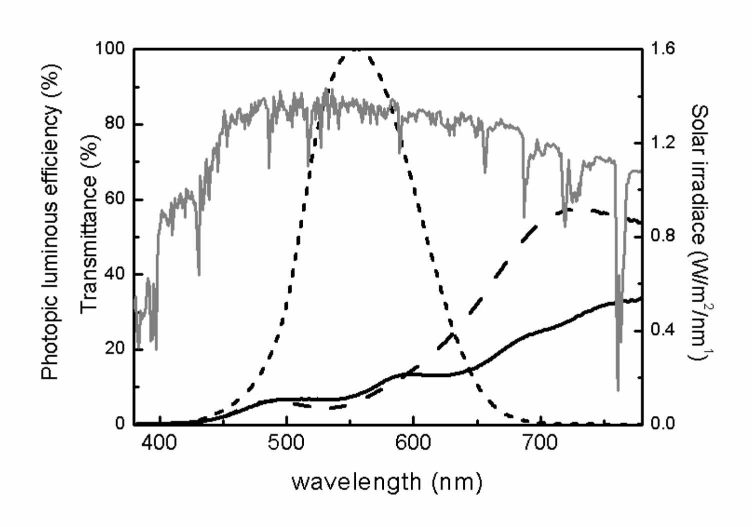


Figure 5. transmittance spectra from a single periodicity multilayer (dark dashed line) and a triple periodicity multilayer (black solid line) integrated in a dye solar cell. Photopic spectral luminous efficiency (black short dashed line) and spectral distribution of solar radiation AM 1.5 spectrum (grey solid line).

Angular effects observed for white light reflecting photonic crystal based cells versus standard or scattering layer based cells

The current intensity-voltage (IV) curve from white light reflecting PC, reference DSC and diffuse scattering based dye solar cells were measured under standard illumination conditions (100 mW/cm2, AM 1.5G) at different light incidence angles. An example of IV curves taken at (a) θ=0, (b) θ=30 and (c) θ=60 degrees is shown in figure S6.

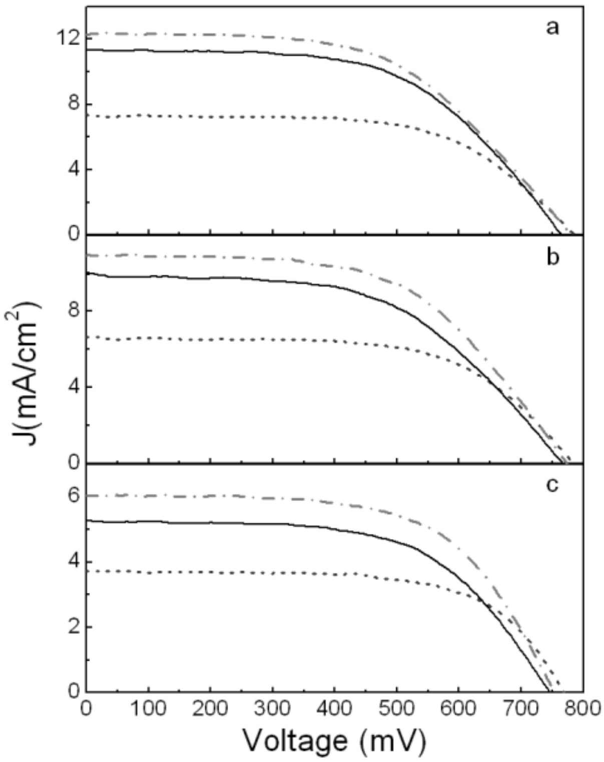


Figure S6. IV curves measured for a reference cell (dark grey short dashed line), a diffuse scattering based cell (grey dashed-dotted line) and a panchromatic specular reflector based cell (black solid) ((a) 0, (b) 30, (c) 60 degrees).

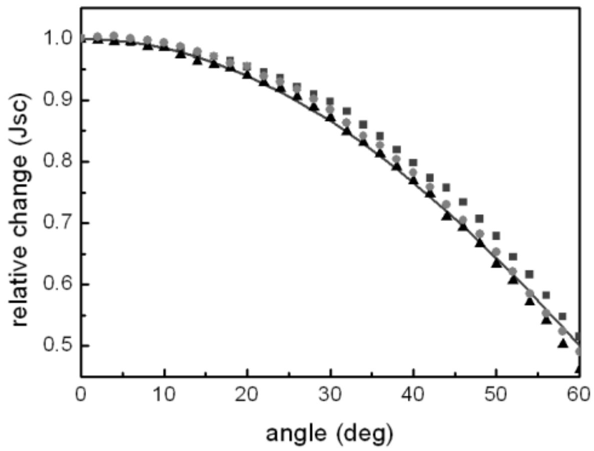


Figure S7. Normalized J_{sc} for a reference cell (dark grey squares), a diffuse scattering based cell (grey circles) and a panchromatic specular reflector based cell (black triangles) and cosine curve (grey solid line), as extracted from angular measurements of IV curves like those shown in Figure S6.