Supporting Information

Wafer-Scale Nanoconical Frustum Array Crystalline Silicon Solar Cells: Promising Candidates for Ultrathin Device Applications

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1. Diffraction in patterned cells

Figure S1. Diffraction angles of grating structures having a period of 510 and 800 nm. Lines, denoted by diffraction order (m), represent the diffraction angle; the gray lines indicate the critical angle (θ_c) as a function of wavelength for total internal reflection (TIR) that occurs at the back surface of the Si absorber. Long-wavelength light (>800 nm) can reach the bottom surface of the 10-μm-thick Si, because the penetration depth is comparable or longer than the thickness. Thus, the grating-induced diffraction enables very efficient light trapping in thin Si absorbers.
2. Fabrication of Nanopatterned Solar Cells

Figure S2. Fabrication process of nanopatterned Si solar cells.
3. Field distribution in patterned cells

Figure S3. Spatial distribution of normalized electric field intensity, $|E/E_0|^2$ ($E_0$: electric field of the incident light), for the six different nanopatterns, for a wavelength of 980 nm. Some of the field profiles (in particular, those for N2, N3, and N5) exhibited clear intensity modulation along the lateral direction. Such superior light trapping capability is consistent with low transmission loss (Figure 2b) and the enhanced absorption spectra (Figure 2c) of the patterned 10-μm-thick Si absorbers. The scale bar is 100 nm.