Supporting Information for Modeling Light Trapping in Nanostructured Solar Cells

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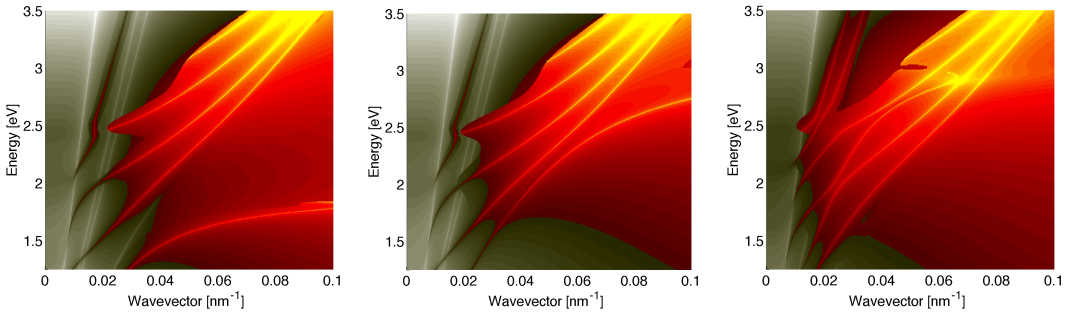

(a)0 nm ZnO:Al (b)10 nm ZnO:Al (c)130 nm ZnO:Al

FIG. 1: Dispersion relations for flat layer stack of Ag/varying ZnO:Al thickness/160 nm a-Si:H/80 nm ITO/air.

I. EFFECT OF ZNO:AL LAYER THICKNESS ON MODE STRUCTURE

Dispersion relation calculations are shown in Supplementary Figure 1 under transverse magnetic (TM) polarization, the polarization which supports SPP modes. The calculations are done for a flat layer stack consisting of Ag/ varying ZnO:Al thickness / 160 nm a-Si:H / 80 nm ITO / air. When the ZnO:Al layer is absent, the lowest order mode lies to the right of the light line and is the SPP mode. With only 10 nm of ZnO:Al, this mode has shifted significantly, and with 130 nm of ZnO:Al (as used in the experimental devices and in all of the simulations in the main text) the mode has shifted to significantly higher energy and no longer lies to the right of the light line. The lowest order mode in this case is now one of the photonic modes of the cell, with peak intensity inside the a-Si:H layer. This has been described in detail by others in Ref. 39.

While the peak intensity for these modes is located inside the a-Si:H layer, they may still be hybrid modes that retain some plasmonic character on the Ag/ZnO:Al interface, and these modes may be lossy in materials other than the photocurrent generating a-Si:H region. Long wavelength absorption in the metal, such as in Fig. 4 in the main text, can be due to the overlap of these photonic modes with the Ag.