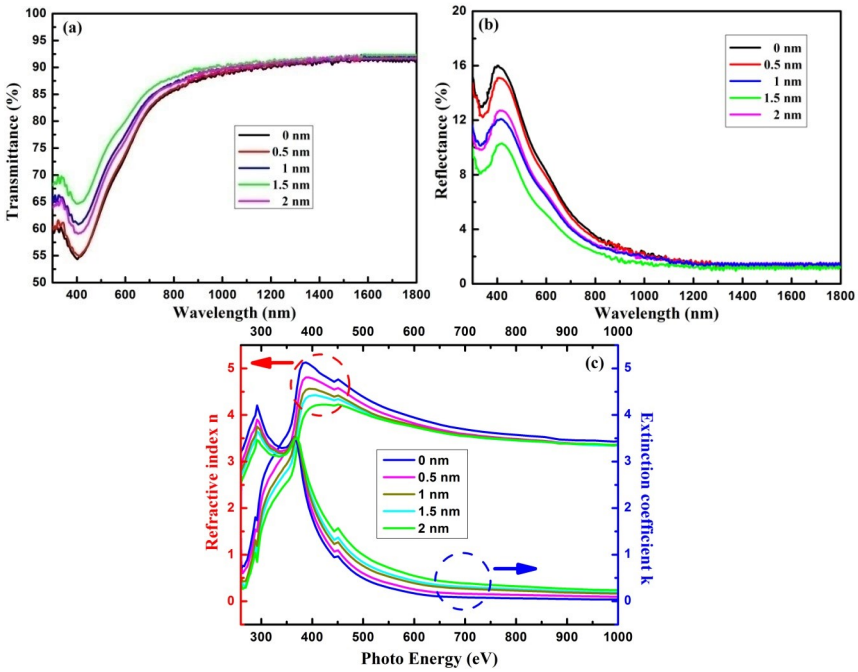

Figure S1. Al_2O_3/MoS_2 laminated film (a) transmittance curve, (b) reflectance curve, and (c) the change rule of refractive index n and extinction coefficient k.

Figure S1 exhibits the optical properties of Al_2O_3/MoS_2 laminated films with different thicknesses. The transmittance variation of the Al_2O_3/MoS_2 samples in Fig. S1(a) highly corresponds to their reflectance resulting in Fig. S1(b). As the samples transmittance increases with increasing Al_2O_3 thickness, their reflectance has been decreasing. When the Al_2O_3 thickness over 1.5 nm, the transmittance begins to decline, while the reflectance turns to rise. These results indicate the optical antireflective effect of Al_2O_3 as the window of MoS_2/Si solar cells, with the maximum light absorption attaining at appropriate Al_2O_3 thickness of 1.5 nm. The ellipsometry spectroscopy in Fig. S1(c) reveals the origins of Al_2O_3 antireflection. The refractive index n gradually decreases in the range of 300-600 nm, and the extinction coefficient k decreases within 400 nm and increases in the medium and long wavelength range of 400 nm-1000 nm.

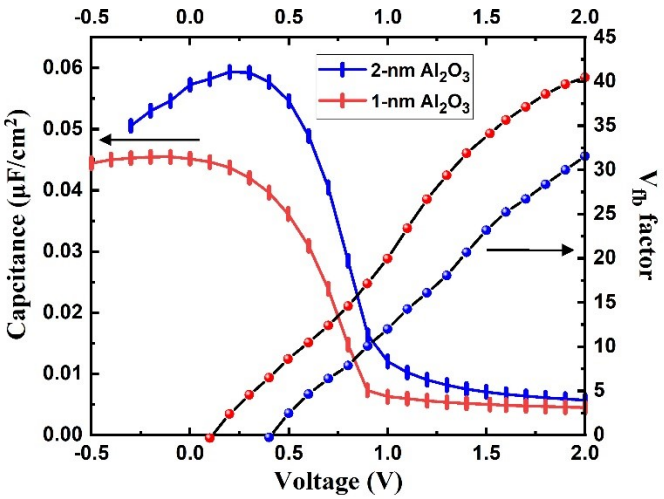

Figure S2. C-V curves of Ag/Al_2O_3/p-Si V_{fb}=0.11 V and 0.41 V.

Figure S2 collects the C-V curves of Ag/Al_2O_3/p-Si structure at 100-kHz frequency. The flatband voltage V_{fb} is the voltage at

$$\frac{C''C}{C'^2} + \frac{3}{2}\left(\frac{C}{3\varphi_t|C'|}\right)^{1/2} - 3 = 0$$

Here, the first (C') and second derivatives (C'') of C-V curves are calculated by mathematical tool with adequate smoothing to avoid noise distortion; φ_t=KT/q is thermal voltage, K is Boltzmann constant, T is absolute temperature and q is elementary charge. The calculated V_{fb} results are 0.11 V for Ag/Al_2O_3(1 nm)/p-Si 1 nm and 0.41 V for Ag/Al_2O_3(2 nm)/p-Si, respectively. The positive V_{fb}s is the indicative for the presence of negative fixed charge in the Ag/Al_2O_3/p-Si stacks for both samples.