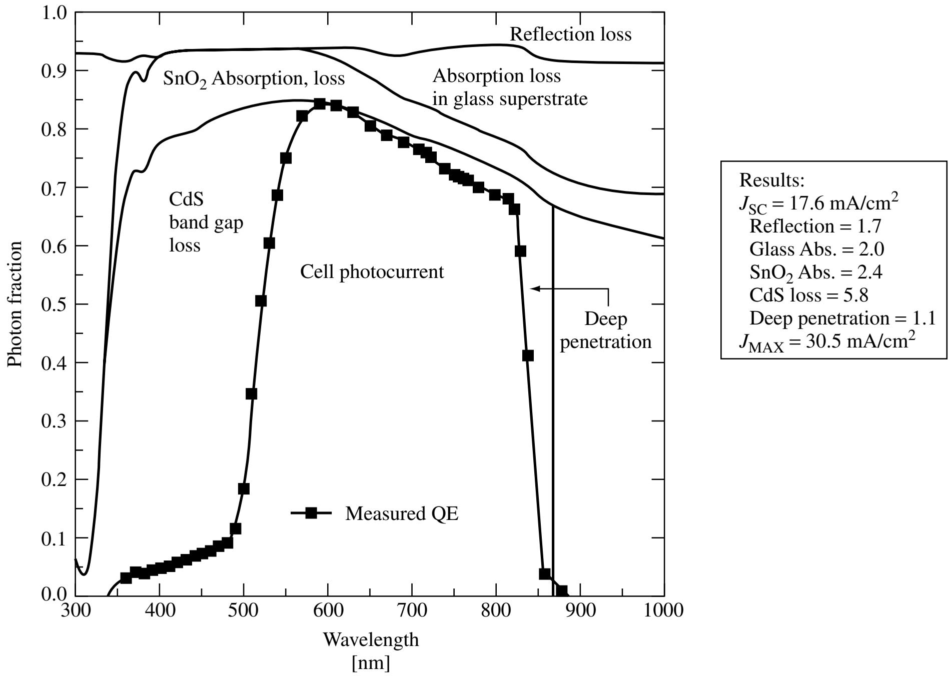

Figure 14.24 CdTe cell photon losses and quantum efficiency versus wavelength [174]

the photons penetrating through the absorber. The QE of a solar cell, especially when combined with independent reflection and absorption measurements of the cell and individual window layers, is a powerful tool to analyze these losses. The data shown in Figure 14.24 are for a CdTe cell with relatively large losses in J_{SC}. This cell, fabricated by Solar Cells, Inc., was deliberately chosen to illustrate the analysis process and is not indicative of the cells currently being manufactured.

To quantify the photon losses in Figure 14.21, the measured QE is multiplied by the light spectrum, in units of photons/cm^2/nm, integrated over wavelength, and multiplied by unit electric charge to yield J_{SC}. For comparison, the maximum current density J_{max} is found to be 30.5 mA/cm^2 for $E_g = 1.5$ eV by a similar calculation up to the band gap cutoff wavelength (vertical line) using unity QE.

The optical regions shown in Figure 14.24 are the reflection from the cell, the absorption of the glass superstrate, the absorption of the SnO_2 conductive contact, and the loss below 500 nm associated primarily with absorption of a ~250-nm-thick CdS window. The separation of individual absorption terms was deduced from the reflection and transmission of partially completed cell structures terminated after each layer. The remaining loss region approaching the band gap is assumed to be due to the photons that penetrated too deeply for complete collection. Integration of these loss spectra, again weighted by the illumination spectrum, gives the current–density loss for each. These losses are listed in the inset to Figure 14.24 for the standard global AM1.5 spectrum [175], normalized to 100 mW/cm^2. The sum of the losses is the difference between the measured and the maximum current densities.