neglect other aspects of power loss in the cell, which apply when field collapse may be neglected [127, 128], in particular for lower intensities.

12.4.3 Absorber Layer Design of a *pin* Solar Cell

In this section we address the issues that determine the absorber (or "intrinsic") layer thickness. Figure 12.17 illustrates a computer calculation showing how the output power of an a-Si-based *pin* cell varies with intrinsic layer thickness. The differing curves represent results for monochromatic illumination using varying photon energies with the specified absorption coefficients. All the curves were calculated for the same photon flux. Such illumination conditions might be achieved experimentally using a laser whose photon energy could be tuned from 1.8 to 2.3 eV; sunlight, of course, presents a much more complex situation, as we discuss in Section 12.4.6.

We first discuss results for illumination through the p-layer (solid symbols in the figure). For intrinsic layers that are sufficiently thin, the power is proportional to the number of photons absorbed (i.e. to the product of the thickness d and the absorption coefficient α). In this limit the fill factors have nearly ideal values around 0.8.

As the thickness of the cell increases, the power saturates. First consider the behavior for strongly absorbed illumination ($\alpha = 100\,000$/cm – corresponding to a photon energy of about 2.3 eV in Figure 12.2). Power saturation occurs for thickness greater than 100 nm, which is the typical distance at which the photons are absorbed. Since thicker cells do not absorb much additional light, the power stops increasing past this length.

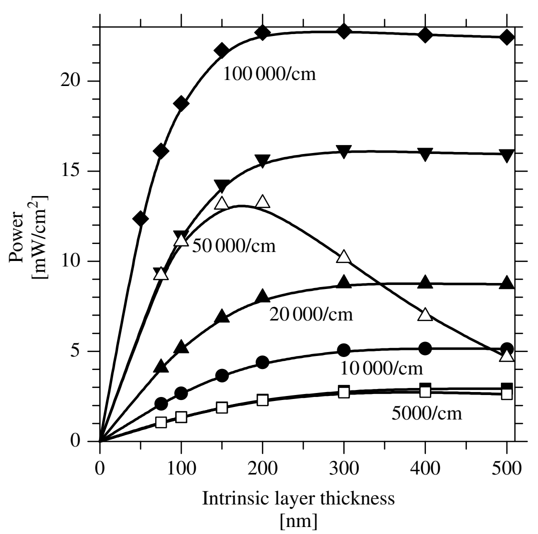

Figure 12.17 Computer calculation of the power output from a *pin* solar cell as a function of intrinsic layer thickness. The differing curves indicate results for monochromatic illumination with absorption coefficients from 5000/cm to 100 000/cm; for typical a-Si:H, this range corresponds to a photon energy range from 1.8 to 2.5 eV (cf. Figure 12.2). Solid symbols indicate illumination through the p-layer and open symbols indicate illumination through the n-layer. Incident photon flux 2×10^{17}/cm^{2}s; no back reflector