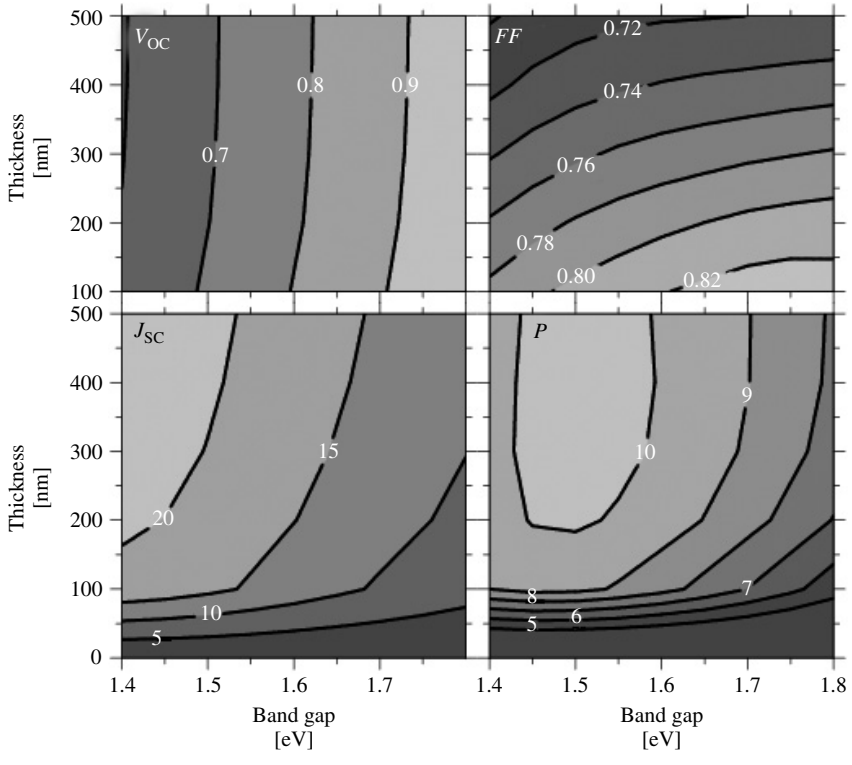

Figure 12.20 Model calculations of the short-circuit current J_{SC} (mA/cm^2), open-circuit Voltage V_{OC}, (V), fill factor FF, and power P under AM1.5 illumination for a-Si:H-based *pin* solar cells with varying intrinsic layer band gaps and thicknesses. No back reflector or texturing effects are included

12.4.7 Light-soaking Effects

In Figure 12.21 we illustrate the power output (standard solar illumination) of a series of cells of varying thickness prepared at United Solar Systems Corp. [14]. The cells are "substrate" type cells prepared on stainless steel. Results are shown both for the initial state of the cells and after 30 000 h (degraded state). For the initial state of the cells, the power rises with thickness and saturates for thicknesses greater than about 400 nm, which is more or less consistent with the modeling presented in Figure 12.17. In their degraded state, the cells reach their maximum power for a thickness of around 200 to 300 nm; substantially thicker cells actually lose some power. As we have noted previously, the degradation effect is correlated with the increase in the defect density in a-Si:H as light-soaking proceeds. Although we did not include defects in the modeling presented in this section, one can understand the degradation effect qualitatively as a result of hole trapping by light-induced defects instead of by valence bandtail states. We do not know whether the fact that the power "peaks" in the degraded state for thicknesses greater than about 300 nm is due to back reflection (cf. Figure 12.19) or due to subtleties in the profile of light-induced defects.