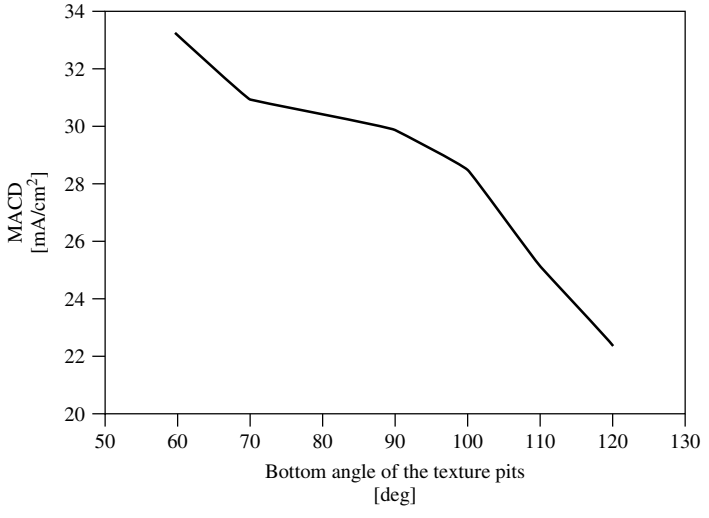

Figure 8.18 The calculated MACD as a function of the bottom angle of texture pits. Si thickness = 10 μm

wafer-based solar cells that use mechanical grooving and surface-shaping techniques. We have also indicated that in deposited films, the texture angle can be related to the grain size. It is useful to investigate the influence of the texture angle of the pits on the cell performance. Here, we show results of calculations performed with *PV Optics* to study the influence of texture angle on the cell current. We assume a 10-μm-thick absorber layer, having a texture pit 1 μm deep on the front side while the backside is planar, and we change the bottom angle from 60 to 120 degrees. Figure 8.18 shows the calculated MACD as a function of the bottom angle of the texture pits. From these results, it can be seen that MACD will drop by about 30% when the bottom angle changes from 60 to 120 degrees. It is important to point out that the dominant effect of changing the bottom angle is to change the reflectance. Analysis of the reflectance spectra shows that the reflectance increases with an increase in the texture angle (i.e. as the surface becomes smoother) in the wavelength range of 0.4 μm to 0.9 μm. In this wavelength range, the reflectance is primarily from the front surface. Therefore, to get better performance, "sharper" texture pits should be used in the cell design. In wafer-based Si solar cell processing, sharp texture is produced by reactive-ion etching (RIE). In the past, RIE texturing has resulted in cells with lower V_{OC} due to shunting. Such shunting results from breakage of the peaks and (or) penetration of metal through the junction during processing. However, this technology is now used commercially by some solar cell manufacturers.

8.3.2.3 Influence of density of the pits

In some processing techniques, the texture pits cannot cover the surface totally. This example will investigate the relation between the optical properties of the cells and the density of the pits.

Figure 8.19 evaluates the influence of pit density on MACD and metal loss. The MACD increases as the fraction of texture pit area increases.