scatter light entering the cell than at the back-reflection. The same conclusion has been reached by other a-Si solar cell researchers [62, 63]. Another key observation is that any textured surface, front or back, drastically reduces the reflection losses (note how high they are in Figure 8.13(a) between 400 and 1000 nm).

Figure 8.14 shows calculated metallic loss (as mA/cm^2) arising because of the Al back-reflector as a function of the film thickness for three cases of the texture: (1) front-polished and back-textured (FPBT), (2) front-textured and back-polished (FTBP), and (3) double-sided textured (DT). These calculations assume an AR coating consisting of 710 Å Si_3N_4 and 100 Å of SiO_2. It is seen that the metallic absorption is lowest for back-polished configuration for all film thicknesses, and that all losses decrease as the Si thickness increases because less light reaches the back contact.

To further understand the effect of thickness on various optical losses, Figure 8.15 shows the calculated values of reflectance, the Si absorbance, and the metallic loss as a function of wavelength for two different values of the cell thickness. The cell structure, depicted in the inset, consists of front-polished and back-textured surfaces; the cell thicknesses are 5 μm and 15 μm. From this figure, we can conclude that an increased absorbance in the thicker Si film results not only from increased single-path absorption but also because of a reduction in the metal loss associated with reduced energy impinging at the back semiconductor/metal interface.

The details of light-trapping presented in Figures 8.13 to 8.15 provide insight into various mechanisms that control dependence of J_{SC} on the absorber thickness, and the losses arising from metal contacts, for different texture configurations. We can now examine the influence of thickness of a single-junction Si cell on the MACD for different texture configurations. Figure 8.16 shows the calculated MACD as a function of the Si-film thickness for three surface configurations: FTBP, FPBT, and DT. The texture height used in these calculations is 1 μm. It is seen that in all cases the MACD nearly saturates after

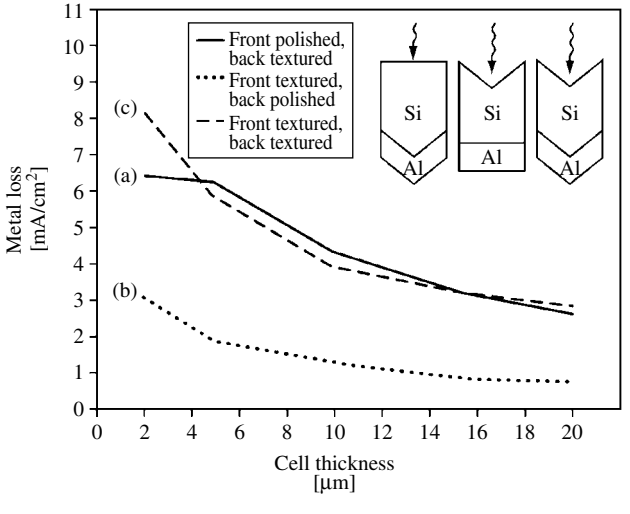

Figure 8.14 Metal loss due to absorption by an Al back-reflector as a function of thickness for three different cell structures. Texture height was 1.0 μm