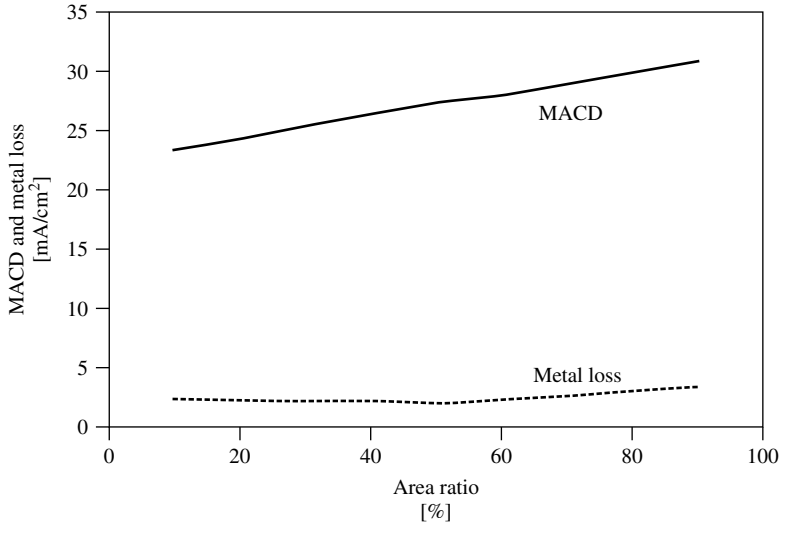

Figure 8.19 Calculated MACD and metal loss as functions of area ratio for a Si cell with 10-μm-thick absorber

8.3.2.4 Summary from optical modeling

From the analysis performed in the preceding sections, we can make some conclusions about the structure of the thin-film solar cells:

1. The thickness of the cell should be 10 to 20 μm in order to get satisfactory J_{SC}.
2. The best structure will be front-surface-textured/backside-polished or front-surface textured/backside-textured.
3. The texture pits should be as sharp as possible, and should occupy the entire surface of the cells.

8.3.3 Electronic Modeling

A generalized electronic model of a TF-Si solar cell should address features such as nonuniformities arising from grain boundaries (GBs) and intragrain defects, as well as detailed optical generation resulting from light-trapping, as illustrated in the previous section. Clearly, this requires a 3-D modeling capability. 3-D modeling is also needed to include metal contacts appropriately. Unfortunately, no modeling package suitable for this purpose is available at this time.

There are two major problems in building an appropriate modeling software for a polycrystalline Si device. First, it is difficult to model electrical fields, recombination, and boundary conditions at GBs and other crystal defects (later we will show one approach to handle fields associated with defects). Second, it is difficult to assign values to parameters associated with defects and GBs. This is because the grain-boundary parameters depend strongly on the interactions of these defects with impurities. For example, clean GBs have been found to have very little electron beam–induced current (EBIC) contrast