Photovoltaic have fabricated TF-Si solar cells with a $V_{OC} = 600$ mV and an efficiency of 10.2%, using a two-phase material with a ratio of a-Si: μc-Si of 4:6 [47, 48].

Recently, a new structure has been proposed at the National Renewable Energy Laboratory (NREL) that integrates several processing advantages in the cell design and overcomes many of the substrate problems [49–51]. Figure 8.11 is a sketch of the cell, which consists of a *p*-type Si film, about 10 μm thick, deposited on a metal-coated glass substrate. An *n*-type junction can be made by any conventional method, followed by an AR coating and front metallization. As illustrated in the figure, the cell has texture on both the back (Si-metal) interface and the front surface. Some other important features of the cell are: (1) the thickness of the Si film is about 10 μm, with a preferred grain size in the range of 10 to 50 μm; (2) it is double-side textured with an AR coating on the front side, and the texture height is about 1 μm; and (3) the substrate material is low-cost glass, which is isolated by a metal layer from the Si layer. The back metal (at the Si-glass interface) has multiple functions – it serves as an optically reflecting back-electrode, a gettering medium, and an interface layer to relieve the stress resulting from thermal mismatch between the glass and Si.

Many cell designs use textured interface(s) and a reflecting back-electrode that is directly located on the thin cell. A disadvantage of the reflecting metallic or conducting oxide back-electrode is that it can lead to significant losses due to optical absorption. However, this loss decreases with an increase in the film thickness. The mechanism of metallic loss is discussed in detail later in Section 8.3.

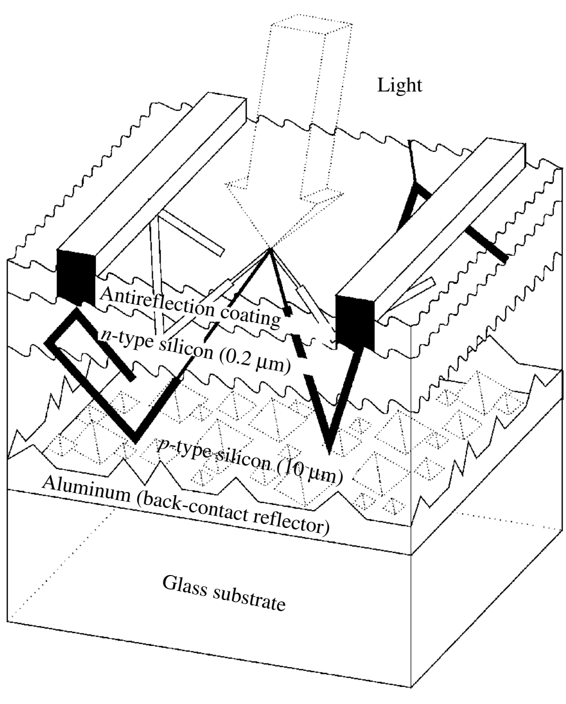

Figure 8.11 A schematic of the proposed thin silicon solar cell