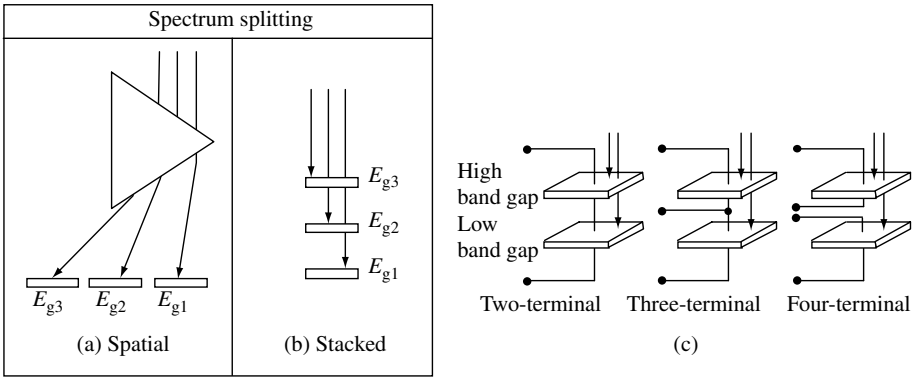

Figure 9.4 Schematic comparison of (a) spatial-configuration approaches and (b) stacked-configuration approaches to distributing light to subcells of different band gaps. (c) Illustration of two-, three-, and four-terminal connection to a two-junction cell. The figure shows the subcells as mechanically separate, but the two- and three-terminal devices can be monolithic

distribute the spectrum to the appropriate junctions for multijunction photoconversion. The band gaps *must* decrease from top to bottom of the stack. The stacked arrangement avoids the necessity for a separate optical element such as a prism to distribute the spectrum. Also, even if the junctions are physically separate from each other, they can be mechanically brought together into a relatively compact package, called a *mechanical stack*. The stacked configuration requires, of course, that all the junctions in the stack except the bottom one be transparent to light below their band gaps, which, in practice, can set challenging constraints on the substrates and the back-contact metallizations of these junctions through which sub–band gap light must pass. An elegant approach to this problem, which has several other advantages as well, is to fabricate all the junctions, each one atop the last, monolithically on a single substrate. This monolithic-stack approach will be the emphasis of this chapter.

9.4 CELL CONFIGURATION

9.4.1 Four-terminal

There are several ways to connect power leads to the junctions comprising a multijunction stack. These configurations, which provide for varying degrees of electrical isolation of the subcells, are illustrated in Figure 9.4(c) for a two-junction stack. In the four-terminal configuration, each subcell has its own two terminals and is electrically isolated from the other subcells. This configuration has the advantage that it sets no constraints on the polarities (p/n vs. n/p) of the subcells, or on their currents or voltages. However, the terminals and the electrical isolation between subcells in the four-terminal configuration would be very difficult to accomplish monolithically, because it requires a complicated cell structure and processing. Generally, a four-terminal device is, of necessity, a mechanical stack, whose complexities of fabrication and assembly make it a significantly less desirable structure than the monolithic device.