is more complex. Again taking the GaInP/GaAs tandem as an example, recall that GaAs subcell J_{SC} depends not only on the GaAs band gap but also on the GaInP band gap, because the GaInP subcell filters the light to the GaAs subcell. When the tandem-cell temperature is raised, the bottom-subcell band gap decreases, tending to increase its J_{SC}; at the same time, however, the top-subcell band gap also decreases, which decreases the amount of light going to the bottom cell and thus minimizes the increase in the bottom-subcell J_{SC} with temperature.

The tandem J_{SC} is limited by the least of the subcell J_{SC}s. In general, these subcell J_{SC}s will not have identical temperature coefficients. For a tandem cell that is nearly current matched, there will, therefore be a crossover temperature below which the tandem J_{SC} is limited by one subcell and above which the tandem J_{SC} is limited by the other subcell. Figure 9.11 illustrates this crossover for a modeled GaInP/GaAs tandem

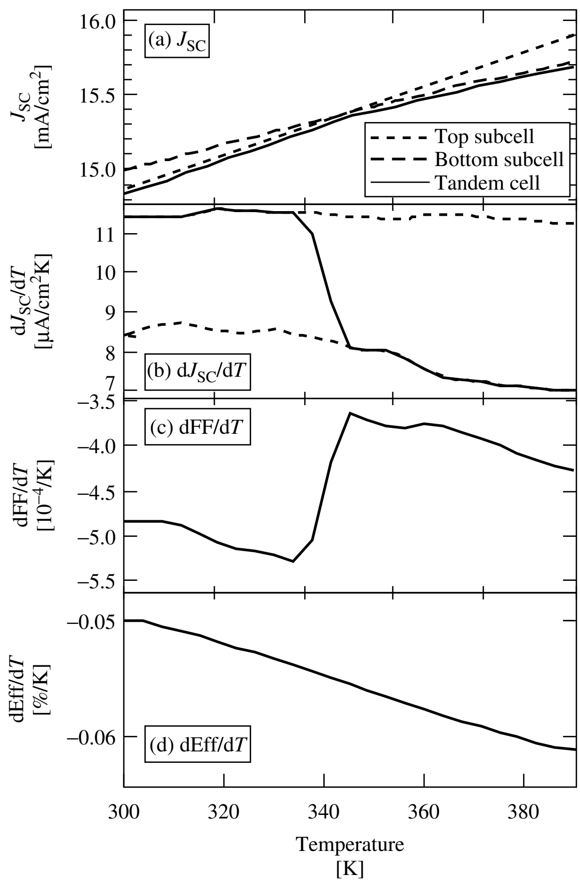

Figure 9.11 (a) Subcell and corresponding tandem-cell J_{SC}s as a function of temperature for a GaInP/GaAs tandem cell that is slightly top-subcell current limited at 300 K. (b) The corresponding temperature derivatives dJ_{SC}/dT. As the cell temperature is raised above ~340 K, the cell crosses over from top limited to bottom limited, and dJ_{SC}/dT changes correspondingly. (c) Tandem-cell fill factor temperature derivative dFF/dT. (d) Efficiency temperature coefficient dEff/dT