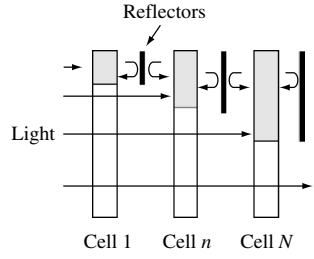

Figure 4.5 Stack of solar cells ordered from left to right in decreasing band gap ($E_{g1} > E_{g2} > E_{g3}$). (Reprinted from Solar Energy Materials and Solar Cells V. 43, N. 2, Martí A. and Araújo G. L, *Limiting Efficiencies for Photovoltaic Energy Conversion in Multigap Systems*, 203–222, © 1996 with permission from Elsevier Science)

reflection threshold of each filter is the band gap of the cell situated above. This prevents the luminescent photons from being emitted for energies different to those with which the photons from the sun are received in each cell. In this configuration, every cell has its own load circuit, and therefore, is biased at a different voltage. It has been shown [31] that a configuration without back reflectors leads to a lower efficiency if the number of cells is finite. For the case of a stack with an infinite number of cells, the limiting efficiency is found to be independent of whether reflectors are placed or not.

For example, for the case of a stack with two cells, the power generated is

$$W = qV_l\lfloor \dot{N}(T_s, 0, \varepsilon_{gl}, \varepsilon_{gh}, H_s) - \dot{N}(T_a, qV_l, \varepsilon_{gl}, \varepsilon_{gh}, H_r)\rfloor + qV_h[\dot{N}(T_s, 0, \varepsilon_{gh}, \infty, H_s) - \dot{N}(T_a, qV_h, \varepsilon_{gh}, \infty, H_r)] \quad (4.52)$$

where the suffixes l and h (low and high) refer to the band gap and the voltage of the two cells involved. The maximum power is obtained by optimising this function with respect to the variables V_l, V_h, ε_{gl} and ε_{gh}. We present in Figure 4.6 the efficiency of

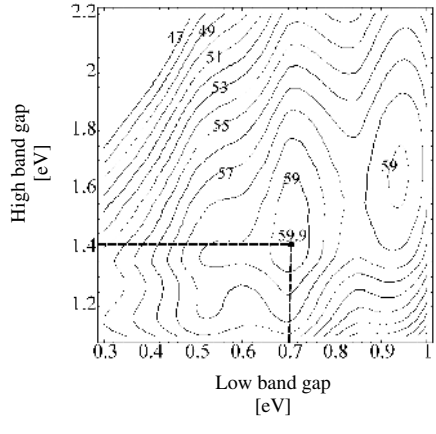

Figure 4.6 Efficiency of a tandem of two ideal cells under AM1.5D illumination as a function of the two cells' band gap ε_l and ε_h