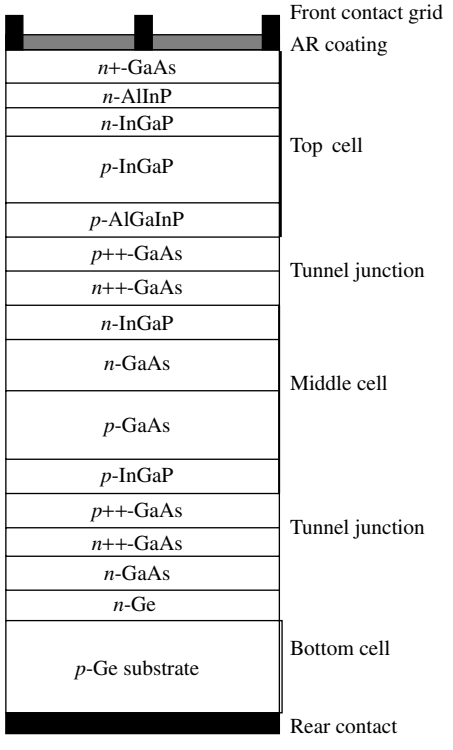

Figure 10.8 Commercially available 26.9% GaInP/GaAs/Ge triple-junction cell

Spectrolab, supplier of more than half of the world's spacecraft solar cells, has reached a milestone of 25 000 triple-junction GaInP/GaAs/Ge solar cells, with a maximum efficiency of 27.1% and an average conversion efficiency of 24.5%. They are currently providing 1 MW of cells to global spacecraft manufacturers (e.g. Hughes Space and Communication Company, Ball Aerospace & Technologies Group, Lockheed Martin, and Boeing). Their high-efficiency cells retain 86% of their original power after 15 years of operation. There is currently more than 50 kW of Spectrolab dual-junction solar cells in orbit.

The new multijunction III-V cells have allowed a reduction in solar array size and mass over the previously used Si cells while maintaining comparable power levels. The alternative way to view the efficiency increase offered by the III-V cells is that they have increased available payload power over using a comparably sized Si array. Scientists expect the majority of the 800 commercial and military spacecraft launched in the next five years to use multijunction III-V technology. This should result in the lower costs for telecommunications, Internet, television, and other wireless services. The AFRL recently initiated a 35% efficient four-junction solar cell program.

Multijunction III-V cells are relatively expensive to produce. The development of large-area arrays using these cells can become cost-prohibitive. One option to reduce the overall cost is to use the cells in solar concentrators, where a lens or mirror is used to decrease the required cell area. The previously mentioned SCARLET concentrator