However, this is not the highest efficiency that can be reached in solar converters. Efficiencies of up to 86.8% can be achieved using an array of solar cells of different band gap, either series-connected or independently connected.

Except for the TPH case, all solar cells operate at ambient temperature. This is a highly desirable feature. The TPH concept, which allows for higher efficiencies at lower temperatures than the TPV concept, may bring some advances. However, such devices to be practical require an almost ideal external quantum efficiency of the LED and the ability of working at high temperatures, both requirements being very difficult to acquire.

Experimental work on IB solar cells – whose upper limit efficiency is 63.2% – is now starting. It is conceivable that IBs may substitute two junction materials with perhaps less complexity. They may also be combined in tandem with more ordinary or IB cells.

Finally, it seems unlikely to us that a semiconductor can be found where the electrons are uncoupled enough from the phonons as to allow effective impact ionisation cells. However, a multilevel organic dye may be found or an array of quantum dots may be engineered where this coupling is reduced. In any case, the operation principles of this cell, and not only that of the usual solar cells, should be taken into account by those trying to bring other technologies into the manufacture of PV converters.

From the preceding statements it is clear that very high efficiencies are possible in a device operating in the PV mode. But what is possible in practice? This is a very difficult question. Certainly, stimulated by space research, there is a trend towards the development of multijunction cells. We stress again here that efficiencies of 34% (Global AM1.5) with a monolithic tandem of InGaP/GaAs, stuck on a Ge cell operating at 212 suns have been achieved. It can be asked whether such solutions are not too expensive for terrestrial use. However, we disagree. The use of very high concentration elements, in the range of 1000 or more, may make very expensive cells [63] usable. Wide acceptance angle concentrators with this concentration factor have already been developed that seem very suitable for mounting in low-cost tracking structures [64].

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