SOLAR PANEL CRACKING

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Over the past few years it has become apparent that some types of solar panels have a far greater tendency to cell cracking than others.

This year at the 2011 Australian-International Model solar Challenge during panel power testing a significant number of car panels (at least 11 of the 32 panels tested) were observed to exhibit cell cracking, some with very significant cracks. In general the competitors were not aware of this cell cracking.

Cell cracking does not always result in a drop in power output, but often will. The wicked part is that any power drop due to cracking can be intermittent depending on how slight movements within the panel position the crack edges. Consequently the power output of a cracked panel often varies in a random way. As an example, an 8.5 watt panel has been observed to drop to 6.75 watts due to cracking. A crack in a critical location can reduce power to zero.

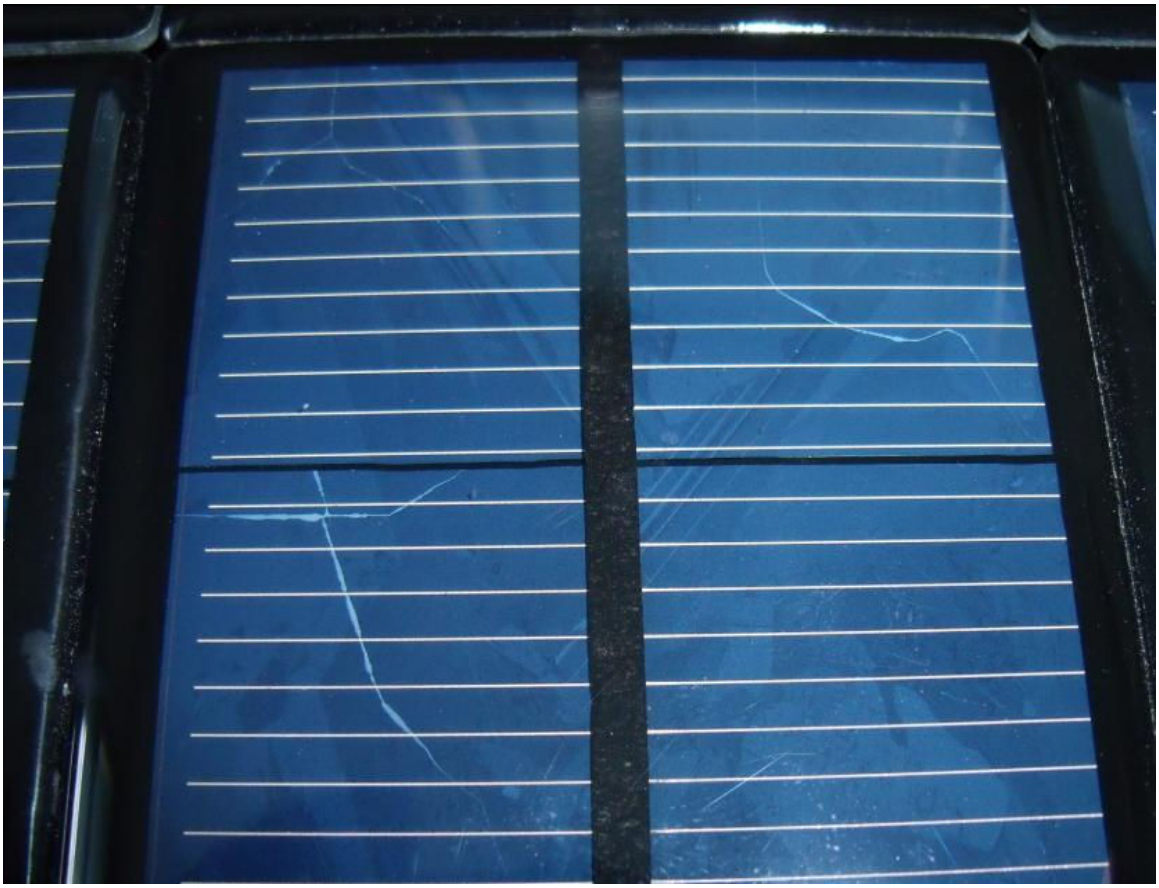

Figure: An example of cell cracking in an Engelec module.

What causes this problem?
In the panels typically used in model solar applications there are two major causes, one being straight out mechanical stress due to deflection (bending) of the panel and the other being thermal stress created by the differential expansion of the materials used in panel construction.
Mechanical stresses can be managed by careful handling, but thermal stress is another matter. In order to produce power the panel must be exposed to sunlight and consequently will heat up causing thermal stress. The practice of cooling panels with ice can also increase this thermal stress.

What type of panel is most at risk of thermally induced cracking?
It has been seen that any panel with hard front cell encapsulation (ie Engelec, Scorpio - not the light weight fibreglass encapsulated panels, Tech Ed, Kite Magic, etc) is likely to be at risk.
Moderate levels of cracking have been observed just by exposing panels with hard front encapsulation to the sun and allowing them to warm up. Testing from a freezer to full sunlight can produce significant levels of cracking.
Cracking of Engelec cells has even been seen to result from the heat applied when soldering a panel together.

In comparison, the Dick Smith three cell modules that were once in common use by many competing in the solar challenge have a soft front encapsulation and have never been seen to crack due to thermal stress, even when cycled from a freezer to full sun many times.

The light weight fibreglass encapsulated car and boat panels from Scorpio Technology, while having a form of hard front encapsulation, do not suffer from thermally induced cracking due to the fact that the front and rear encapsulation are both fibreglass which has a similar thermal expansion rate to the silicon solar cells. This means that there is little or no differential expansion occurring to cause thermal stress and crack the cells.

Commercial glass fronted panels such as the Solarex or BP Solar types also do not suffer cracking. Yes, they have a hard front but the cells are embedded in a soft flexible plastic material behind the glass and this allows them to move without significant stress being generated.