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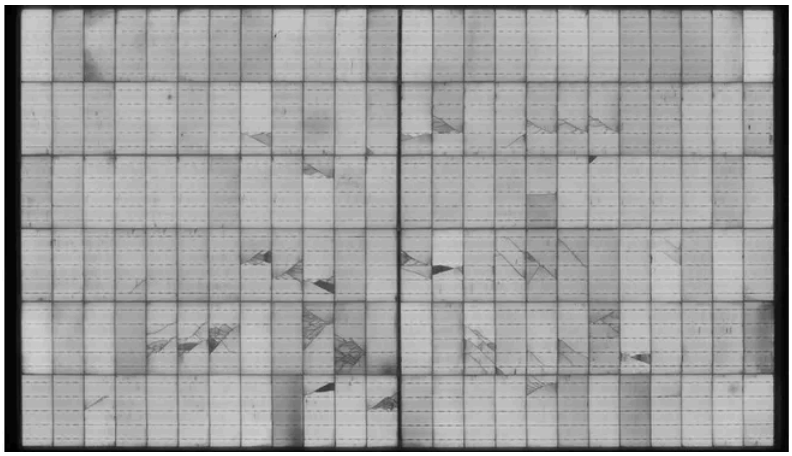
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# Microcracking kills your solar panels

What can you do to avoid it?

Miguel Pacheco Follow 5 min read · Nov 1, 2022

25 1



Microcrack damage on PV cells under EL test (source)

## What is microcracking, and why is it important

Microcracking refers to very minutes cracks on Si PV cells that are invisible to the naked eye. The difficulty in detecting microcracks leads to underperforming PV systems and consequent economic losses.

The cracks increase electrical resistance leading to lower generation.

The microcracks vary in dimension and configuration. Smaller microcracks reduce energy generation. As repeated stress increases, microcracks grow in length, and so do their effects.

In extreme cases, larger microcracks in a PV cell can stop, end energy production in the entire module, and force its replacement. Since PV cells on modules connect a string, a drop of one single PV cell will stop the power output of all modules.

## How microcracking happens?

Microcracks happen from mechanical strain acting on the PV cells. The stress can come from impacts on the modules or repeated cycles of heat and cold that dilate and contract cells.

Microcracks can increase in size over time as mechanical stress accumulates — the more intense and frequent, the more likely for microcracks to grow. PV modules exposed to more mechanical stress display higher degradation rates.

Cracks increase electric resistance in the PV cell, reducing generation. Consequently, hotspots correlate with microcracks. Higher temperatures induce more intense cycles of dilation and contraction in the cells, which increase the chances of microcracks expanding, further reducing performance.

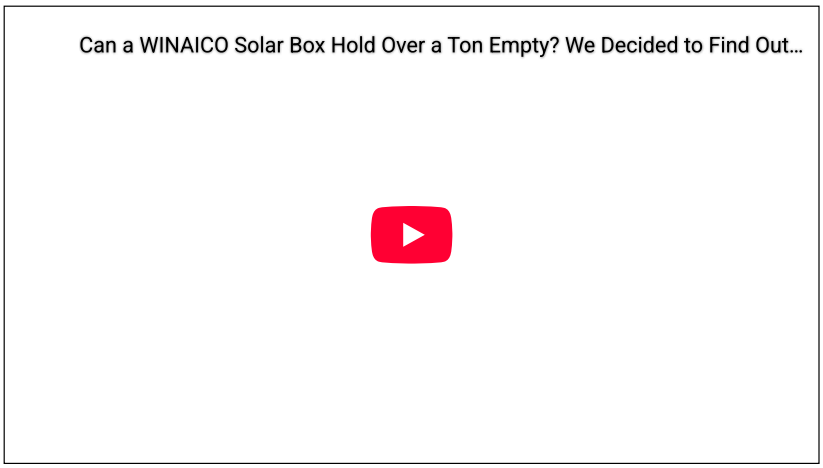
Stress on the PV cells can occur throughout its life cycle. From production to operation in the field, measures to deal with microcracking must occur during all phases.

Microcracking can happen during wafer production. Sound manufacturing techniques should minimize microcracking from occurring in the first place. In addition, microcracking detection practices avoid shipping defective PV cells.

Transport of PV modules also can result in microcracking. The transportation of PV modules from the factory to the installation site must follow procedures to minimize the risk of microcracking.

Transport must focus on proper packaging and handling. Hitting between modules or walls may lead to microcracking, so the correct packages and packing matter.

Video 1 displays a test on a cardboard package for PV modules. The empty cardboard box holds up with a ton on top. The test shows how the package resists forces to protect the modules inside from damage.




Video 1: Cardboard package for PV modules one ton resistance test (source)

But the the cautions don't end with the package; packing also matters. Modules should store vertically inside their box to avoid increased stress on lower modules (see figure 1).

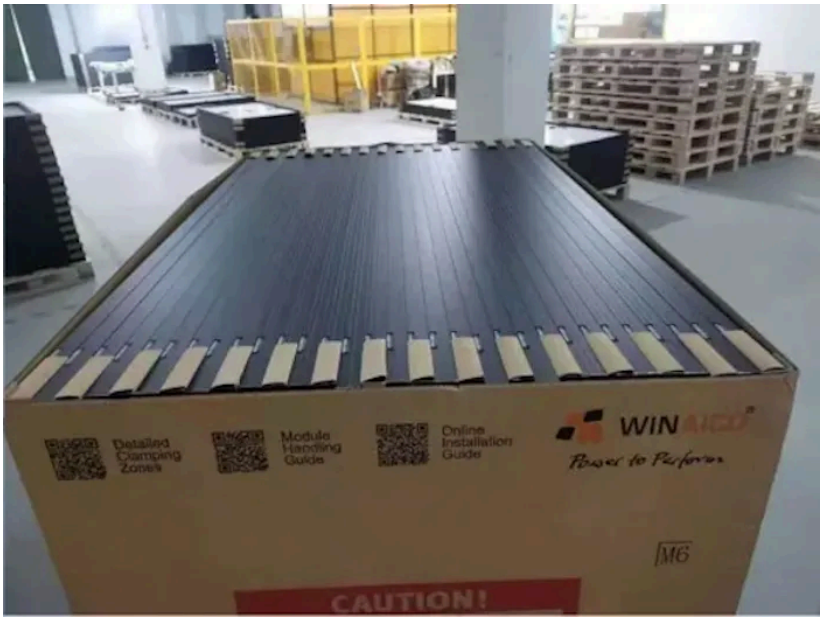



Figure 1: Example of vertical packging of PV modules (source)

Once the modules arrive on the installation site, the best practices focus on handling and assessment. The unloading of PV modules must reduce mechanical stress, which only sometimes happens (see figure 2).



Figure 2: Example of bad unloading of PV modules (source)

After unloading, a microcracks evaluation should follow. The assessment requires a dark room: either a specific or an improvised one. Electroluminescence delivers the most effective results on microcracking detection but needs a dark room environment to work, leading to the use of mobile test trailers (figure 3).




Figure 3: Example of mobile PV test center trailer (source)

Most microcracking occurs during installation. So, after installation, another inspection should happen. Installation requires more handling of PV modules and thus increases the risks of microcracks.

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Figure 4 illustrates two incorrect ways of carrying a PV module. Tests happened after climbing 24 steps, in both runs. PV Generation declined by 1%, more than the average annual performance loss, due to improper handling for only 24 steps.



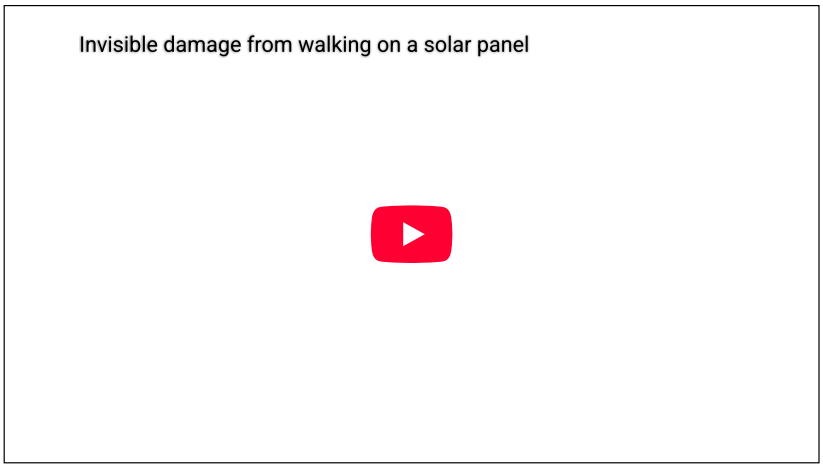
Figure 4: Examples of incorrect carry of PV modules leading to performance drop (source)

In case you left wondering, figure 5 shows the correct carry position for PV modules.




Figure 5: Correct way to carry a PV module (source)

Video 2, by the National Renewable Energy Laboratory, displays how kneeling, walking, and jumping on PV modules instantly creates microcracks.




Video 2: EL Visualization of microcracks from kneeling, walking and jumping on PV module (source)

The need for two separate checks (one on arrival, another after installation) may seem farfetched. However, the two checks have a valid reason: to assign responsibility among different stakeholders.

Inspecting the modules at the site arrival allows for holding the PV module manufacturers accountable. Check modules only after installation does not allow to tell apart the responsibilities between manufacturer and installer, risking a void warranty claim.

If inspection spots microcracking on PV modules after installation with no inspection on arrival, both manufacturer and installer could deflect responsibility to the other party.

This dual testing may seem expensive. However, the two inspections still cost less than voiding the PV module guarantee. Contracts with suppliers should include the demand for checks on arrival and after installation.

In the case of large PV systems, an inspection must rely on sampling. The sample design accurately accounts for the system as an all.

Finally, microcracking can happen after installation. Winds and snow loads add stress to modules and increase microcracking chances. In addition, hail storms can lead to significant damage (see figure 6).

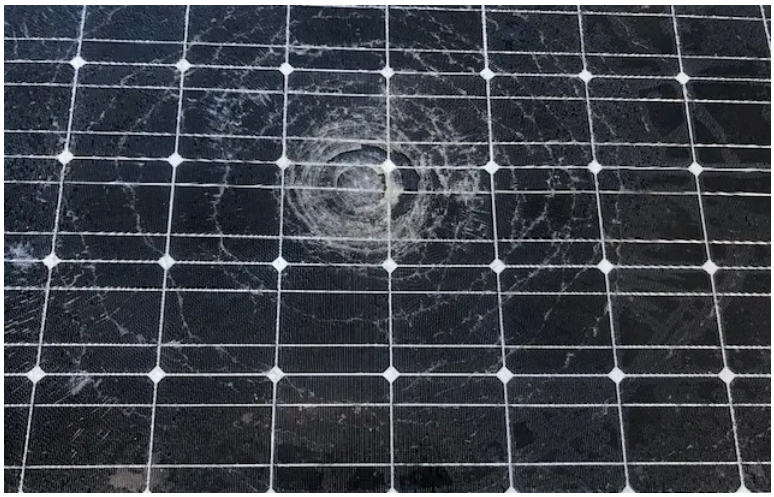


Figure 6: PV module damage from hail (source)

## Is the future more or less prone to microcracks?

The relentless search for efficiency in PV manufacturing led to incrementally thinner wafers over the years. Slimmer wafers microcrack more easily. In addition, as PV modules grow larger, they become heavier, increasing microcracking chances during handling and installation.

On the other hand, good PV manufacturers increased their quality control practices on this issue. Understanding power loss happens over time can prove a challenge. Buyers adopting microcrack testing mitigate risks and economic losses.

Module selection, coupled with hiring skilled personnel, also mitigates risk. Glass/glass modules resist better sheer. Modules with more interconnected wires and parallel wiring also fare better. In addition, good practices in packaging, unpacking, handling, and installing PV modules.

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