

**Topic: TCO Corrosion**

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**Technical Information:**

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Whilst many thin film modules suffer from degradation as a result of the corrosion of the Transparent Conductive Oxide (TCO) layer, this is not a problem with UNI-SOLAR's products due to the unique design of our cells and laminate.

Field tests conducted by the Florida Solar Energy Center and the Jet Propulsion Laboratory demonstrated that TCO corrosion affected both a-Si and CdTe thin film modules when these modules were manufactured by depositing the thin film layers onto special glass coated with a Transparent Conductive Oxide (TCO) layer.

The film corrosion, or de-lamination, is caused by a reaction between the sodium in the soda-lime glass and the TCO layer. The extent of this corrosion was affected by

- the accumulation of free sodium ions present in the glass,
- humidity,
- elevated temperatures, and
- leakage currents to ground.

Modules affected by this effect can suffer significant loss of power within the first few months of installation. Contrary to other types of degradation that commonly occur in thin film modules TCO corrosion causes irreversible damage and premature failure.

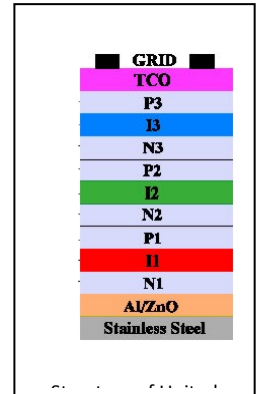
Field studies have shown that the TCO degradation is much more pronounced when the modules are surrounded by metallic frames and the most destructive condition exists when the cell is biased negatively relative to ground. Leading inverter manufacturers recommend using galvanically isolating inverters, and connecting the negative pole of the PV generator to ground to reduce the effect of TCO corrosion.



United Solar Ovonic's products are significantly different from TCO glass thin film modules; as a result, our products are not prone to TCO corrosion effects.

Our solar cell and module manufacturing process does not incorporate TCO coated glass but instead uses

- A patented roll to roll process to deposit the different thin films onto a 2500m long roll of stainless steel.
- A TCO layer of indium tin oxide (ITO) applied to the top surface of the cell (rather than to glass)
- A unique module construction which incorporates
  - A highly transmissive plastic (ETFE) as the front surface
  - Laminate construction with no metallic frames.



As a result of this unique cell and module structure United Solar Ovonic's products are not affected by TCO corrosion and it is not necessary to ground the module by connecting a negative pole to ground to prevent module damage. (Note: grounding of the module may be a requirement of the electrical codes applicable in the area where the system is installed.)