Correlating IR Thermography with Electrical Degradation of PV Modules (PV-5)

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Scientific Achievement:

We correlated power degradation rate of field-aged modules to the module temperature data obtained from infrared (IR) thermography. Modules with higher temperature inhomogeneity (*module ΔT*) degrade at a faster rate, mainly due to faster degradation in the fill factor.

Significance and Impact:

Module reliability is shown to be affected by temperature inhomogenities, caused by the cell-to-cell mismatch, which needs to be studied in more detail.

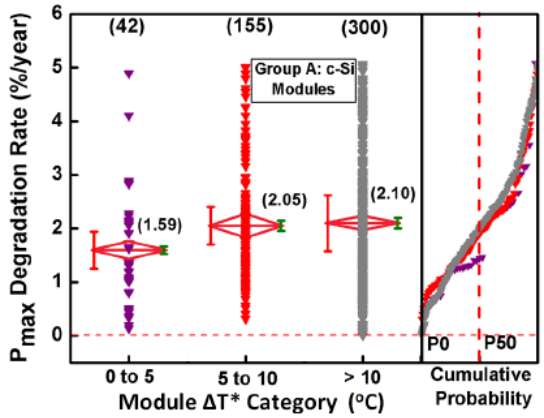
Research Details:

- All India Survey of Photovoltaic Module Reliability was conducted in 2016, in which 950 field-aged modules were inspected from all over India.
- Software developed in-house to extract the region of interest from the IR images, which has enabled fast analysis of the IR data.
- The temperature inhomogenity in the module is quantified in terms of the *module ΔT* (= Maximum temperature in the module – Modal temperature obtained from temperature histogram).
- The *module ΔT* is linearly translated to 1000 W/m^2 irradiance using the following relation:

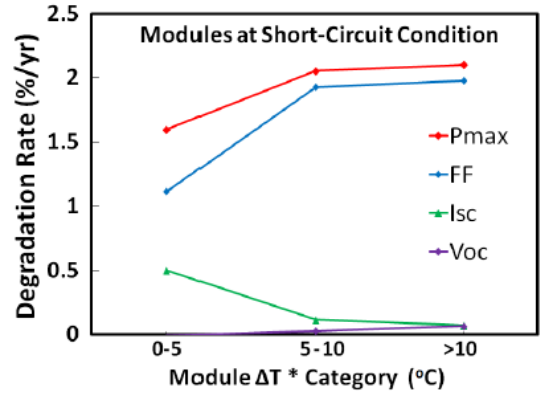
  *module ΔT** = *module ΔT* x (1000 / G),

  where G is the plane-of-array irradiance at the time of measurement.

(a)



(b)



(a) P_{max} degradation rate for various categories of *module ΔT*
(b) Degradation rates of different electrical parameters for different categories of *module ΔT*

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