Potential Induced Degradation (PID) effects on PV modules

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Testing | Consulting | Research
Overview

1. Under which circumstances do PID effects appear?
2. PID influencing test parameters
3. PID effect on CiGS-Modules
4. PID test sequence according to PI-Berlin standard
5. Summary
1. Under which circumstances do PID effects appear?

Fig. 1: Overview of leakage currents in a solar module

20 x 35V = 700V

PV+

PV−

[IEEE PID Paper 2010 Pingel Solon]
2. PID influencing test parameters

- Humidity

Fig. 3: PID treatment with different humidity conditions
2. PID influencing test parameters

- Applied voltage

Fig. 2: Modules tested with increasing voltage
2. PID influencing parameters

- Temperature

48h / 25°C / 85% RH

48h / 85°C / 85% RH

Fig. 4: Modules tested at different temperatures
2. PID influencing test parameters

• Contact situation

1) Field modules – frame grounded
2) Lab tested modules - frame grounded
3) Lab tested modules - surface grounded

Fig. 5: Modules tested with different grounding
3. PID effects on CIGS Modules

Initial 68h / -1000V 66h / +1000V

$\Delta P - 80\%$

$\Delta P - 30\%$

Fig. 5: CIGS modules tested with different potential

$P = 100\%$
4. PID test according to PI-Berlin standard

Initial measurements:
Pmax @ STC, Electroluminescence analysis

PID test sequence:
-1000V, 85% RH, Grounding via frame, 85°C, Degradation period 48h

Final measurements:
Pmax @ STC, Electroluminescence analysis

PID quality categories:
- Class A → ΔP < 5%
- Class B → 5% < ΔP < 30%
- Class C → ΔP > 30%

Fig.6: PID standard test sequence
4. PID test according to PI-Berlin standard

PID quality categories:
- Class A \( \Delta P < 5\% \)
- Class B \( 5\% < \Delta P < 30\% \)
- Class C \( \Delta P > 30\% \)

Fig. 6: First results of PID standard test sequence
4. PID test according to PI-Berlin standard

PID working group:

- VDE
- PI
- TÜV Rheinland
- SCHOTT solar
- Q.Cells
- Solon
5. Summary

- PID is influenced by:
  - System voltage
  - Humidity
  - Temperature
  - Contact situation

- The PID effect is not restricted to crystalline technologies it is also a known problem for thin film technologies.

- PI-Berlin offers test sequences for PID and is working on industry standards.

- The PID test can just show if a module is susceptible to PID or not. Till now there are no simulation programs available which allows a forecast for module behaviour in the field.