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RAPID PID TESTING AND ASSESSMENT OF PID STABILITY AT INSTALLED PV MODULES

Volker Naumann[1,*], Nadine Schüler[2], Christian Hagendorf[1]

[1] Fraunhofer Center for Silicon Photovoltaics CSP, 06120 Halle (Saale), Germany
[2] Freiberg Instruments GmbH, 09599 Freiberg, Germany | www.freiberginstruments.com
*Corresponding author, email: volker.naumann@csp.fraunhofer.de

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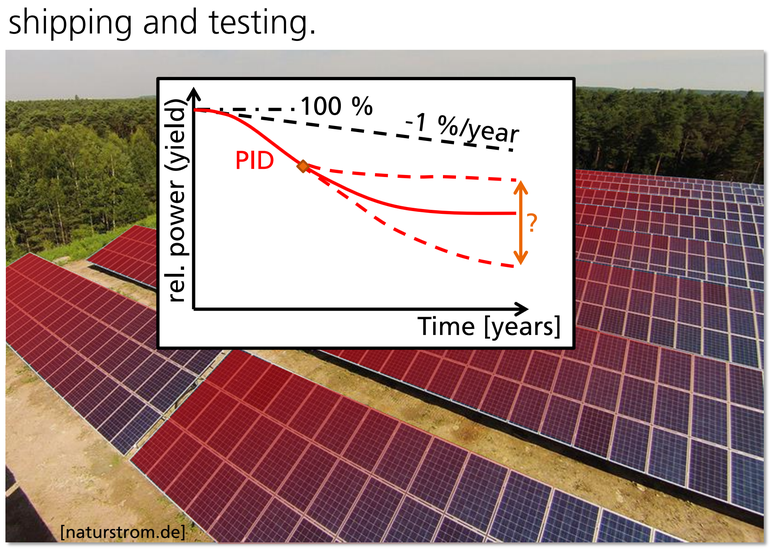
INTRODUCTION

Up to now the susceptibility of PV modules to Potential Induced Degradation (PID) is usually assessed through laboratory tests. For PID monitoring in operating PV power plants modules are often dismounted in order to perform PID tests in the lab. This causes high effort for dismounting, shipping and testing.



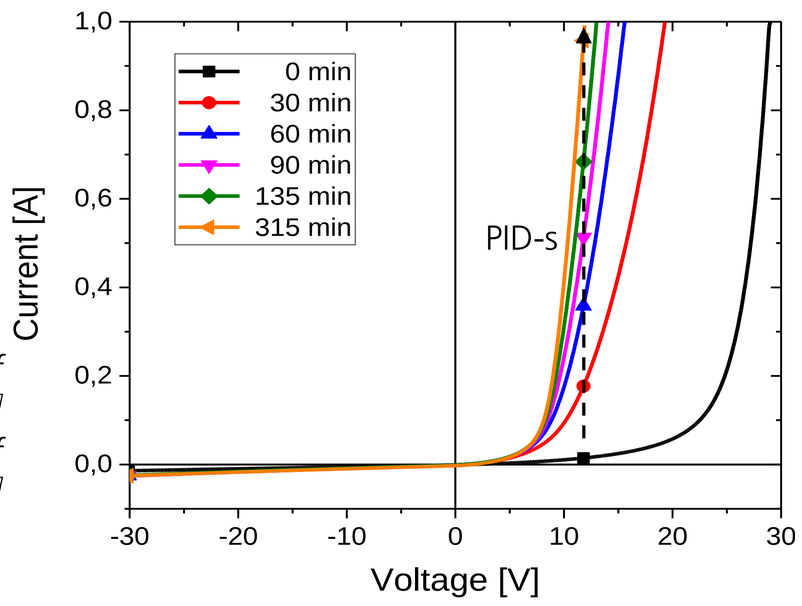
In this work, an approach is presented for **quick on-site PID testing** of mounted PV modules, allowing **diagnosis and prognosis of PID-related yield losses**.

PID in a PV power plant (figurative)

EXPERIMENTAL APPROACH

- Setup based on IEC TS 62804-1, Stress method b), "contacting the surfaces with a conductive electrode": grounded electrode on front surface
- Heating pad on front surface for test acceleration at increased temperature
- PID-test at temperature of 85 °C and with a voltage of -1000 V at cells with respect to grounded glass surface
- Repeated measurement of dark current at forward bias of ~1/3 V_{oc} [1]
- 24 of 60 cells in a module are subject to high PID stress simultaneously by heating and homogeneous grounding of front glass surface
- Can be applied easily in large scale PV power plants:
  - Simple heat isolation
  - Module under test is bridged over, rest of string remains in operation
- Tested module can be recovered after PID to restore initial power

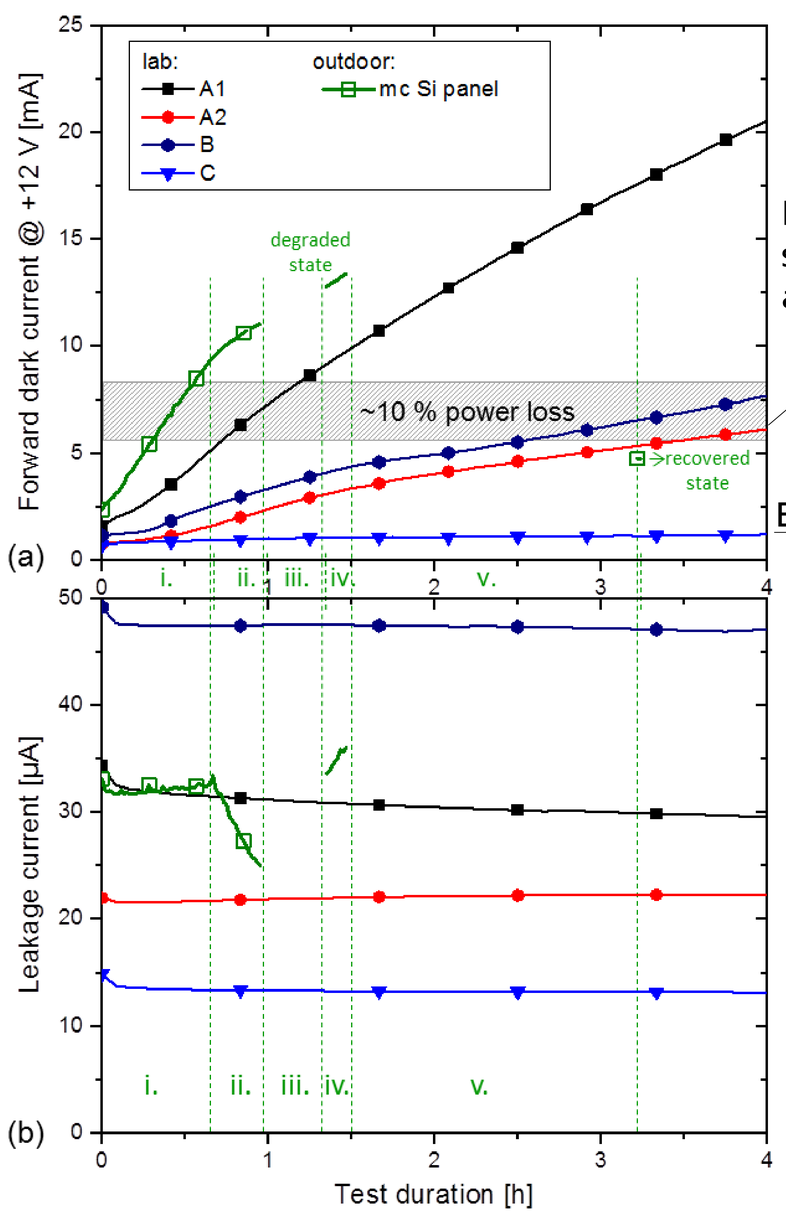
PID test with 'PIDcheck' prototype at remote location under harsh conditions (windy, rainy, cold)

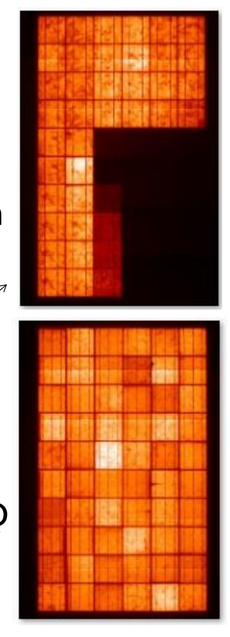


Dark I-V curves of complete module [1] exhibit evolution of PID-shunting [2]

RESULTS

- Modules with different PID susceptibility tested in lab as a reference basis
- 2 modules (1 shown below) tested outdoors, demonstrating applicability





Outdoor PID test:

i. PID test (85 °C)
ii. PID test (cool down)
iii. heat up again
iv. PID test (85 °C)
v. recovery and short measurement after recovery

Measured dark current at forward bias of 1/3 V_{oc} (a) and leakage currents (b) during PID tests; electroluminescence (EL) images prove evolution of PID

- PID tests using this setup reveal excellent sensitivity for PID-s (-shunting) [2] prone modules, able to **determine the stability against PID-s**
- Increase of dark current corresponds to shunting degree of stressed cells

CONCLUSION AND OUTLOOK

- PID-test solution for outdoor-mounted solar modules successfully tested
- Further studies: degradation, regeneration (with reversed high voltage) and cyclic testing for assessment of PID susceptibility; prediction of future yield
- **Measuring device 'PIDcheck' for in-field PID-testing** available by Freiberg Instruments, starting in summer 2018

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References

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