PV monitoring solutions

In-situ monitoring of moisture ingress in PV modules

Compatible
- Reliable RH & T measurement in different encapsulants, such as EVA, TPO, POE, Ionomer, ...
- WVTR and water diffusion parameters can be determined

Miniature
- Minimal impact to the measured specimen
- Standard I²C interface compatible with most digital sensors
- Up to 10 sensors per strip, 30 sensors per DAQ card

Durable
- Large RH&T measurement range with high measurement accuracy
- Suitable for indoor and outdoor monitoring conditions
- Long term monitoring over several years

Encapsulated sensors

Sensor in the air
SYSTEM CHARACTERISTICS

- Use of off-the-shelf miniature air relative humidity and temperature sensors SHT-25 from Sensirion.
- Custom made sensor strips holding sensors on fixed positions and connecting to the DAQ card. Sensor strips can be laminated in various PV module stacks. Custom sensors strips can be designed to fit the specimen.

Example of sensor strip with 4 sensors for glass/backsheet stacks.

Example of sensor strip with 10 sensors for glass/glass stacks.

* Strip thickness is 1 mm. All measures are in mm.

- Data acquisition (DAQ) card with USB and RS-485 interface with 30 multiplexed I2C interfaces. Although only SHT25 sensors are currently used, any 3.3 V powered I2C compliant sensors can be supported by firmware upgrades.
- Simultaneous data acquisition of all sensors with adjustable sampling time from 2 s forward.

SENSOR MEASUREMENT RANGE AND UNCERTAINTY

Sensor can be exposed to normal outdoor PV module operation conditions. It has also proven to withstand long term Damp Heat (DH) conditions (just over the edge of extended measurement range) with drift of +5% RH. Long term exposure to relative humidity above 80% and condensing conditions can cause reversible drift up to +3% RH.

Several sensor were laminated in four different encapsulant materials (EVA, TPO, POE and Ionomer) and exposed to different air humidities at elevated temperature of 50 °C. Results show stabilized readings of sensors showing minimal scattering. Comparison of the external and internal RH readings proves very consistent linear relationship.

REFERENCES

Detailed system and result description can be found in: