Pre-normative characterization of multi-junction photovoltaic modules

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SUPSI: supporting PV innovation

TISO 10 kW:
1° grid-connected PV system in EU
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1982

Outdoor testing

TISO: 1° grid-connected PV system in EU

1992
SUPSI: supporting PV innovation

1982

2000

TISO: 1° grid-connected PV system in EU

Indoor testing

Outdoor testing
SUPSI: supporting PV innovation

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2010

ISO 17025 accreditation

Indoor testing

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2010

2014

TISO:
1° grid-connected PV system in EU

CB Testing Laboratory

ISO 17025 accreditation

Indoor testing

Outdoor testing
TISO: 30+ years ago
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37 W peak c-Si modules by ARCO Solar

module efficiency: 10%

3 strings, 8x12 modules each

total: 288 modules

total power: 10.6 kW peak
TISO: 30+ years ago

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Towards new generation?

Pravettoni, Manni, Strepparava, *Coatings*, to be published
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How multi-J may show the same reliability as the “good old silicon”?
Electrical characterization of multi-junction modules

1) spectral responsivity measurement
2) best reference cell selection
3) calculation of the spectral mismatch
4) spectral tuning to decrease spectral mismatch
5) correction to STC
Spectral tuning: theory

![Graph showing spectral tuning for different PV technologies: c-Si, a-Si:H, uc-Si, PSSC. The graph plots wavelength in nm against spectral irradiance in W/m²/nm, with bars representing the spectral distribution as a percentage.]
Spectral tuning: theory
Spectral tuning: theory

- a-Si (top)
- c-Si (top)
- uc-Si (bot)

- a-Si (bot)
- c-Si (bot)
- PSSC (top)

- a-Si: H (top)
- uc-Si (bot)

- c-Si: H (bot)
- PSSC (top)

- c-Si (bot)

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sp. irr. [W/m²/nm]

- wavelength [nm]

- PV technology

sp. distr. [%]
Spectral tuning for modules

Spectral tuning for modules

Spectral tuning for modules

An example: a-Si:H/μc-Si:H
An example: a-Si:H/μc-Si:H
An example: a-Si:H/μc-Si:H

![Graph showing spectral mismatch and other parameters](image-url)
An example: a-Si:H/μc-Si:H
Conclusions

Multi-J may enter PV history, as TISO did

Normative activity is ongoing to improve reliability of new generation PV

Multi-J characterization has been challenging so far

Novel solutions to allow spectral tuning at module level were developed at SUPSI
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