Thin film module field test results in Japan: A brief review

Keiichiro Sakurai, Kazuhiko Kato, Tetsuyuki Ishii, Yoshihiro Hishikawa, Michio Kondo
AIST RCPVT, Japan

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http://unit.aist.go.jp/rcpvt/
Overview

• Though Japan has a long experience in commercial deployment of thin film modules, only very few long-term performance data have been made public.

• Regarding the recent international movement (including the QA forum), some manufacturers have decided to disclose data.
• Some have decided to present at upcoming conferences, or have already presented at other conferences.

• This presentation briefly introduces field test data collected by Japanese manufacturers and AIST, including some data from tests in other Asian countries.
Manufacturer A (1/3)
a-Si single junction, full-size rigid modules (total: 66)
due south, rack mounted, 12 years  (Kadota et al, PVSEC-21, 2A-2O-05)

Internal wiring disconnection 
(n=4, excluded)

Average : 7 %
Number : 62 modules

Eff (%)
Manufacturer A (2/3)
Long-term degradation after initial degradation

(Kadota et al, PVSEC-21, 2A-2O-05)

Average: 0.4% per year
Number: 62 modules

Degradation Rate (%/year)
Manufacturer A (3/3)
Simulating the degradation with Accelerated Light Soaking Test (3.5SUN, 20〜80°C)

(Kadota et al, PVSEC-21, 2A-2O-05)

20hrs of Accelerated Light Soaking led to similar efficiency of 〜12 years exposed samples
Manufacturer B

a-Si tandem, flexible modules glued to rooftop slates, 13 years
Prototype modules (commercial products are made to be more durable)

Submitted for presentation at 27th EU-PVSEC (Paris, 30 Sep- 04 Oct 2013)
Quick Summary of the Japanese companies' data:

After the initial degradation,

- Some old-technology-based thin-film Si modules did show fast (>1%/yr) degradation
- Current technologies can maintain degradation rate of TF-Si modules below 1%/year (for both flexible/rigid modules)

- Light soaking at LOW temperatures may help to estimate long-term performance of TF Si modules (will be published from the manufacturer in the near future)

- Disconnection of internal wiring observed in some cases
Field test at AIST (Tsukuba, Japan) (pc-Si, sc-Si, a-Si, CIGS, HIT)

- Running since 2004
- So far the first 4 years of data has been published
- The trend seems to be continuing up to now

Monthly average performance ratio

**sc-Si**

**HIT**

**a-Si**

**CIGS**

- Initial degradation
- Light soaking
AIST modules:

To stabilize the performance outdoors, 2 years were required both for a-Si and CIGS

- Initial degradation of a-Si modules lasted for ~ 2 years
- Initial light soaking effect of CIGS modules lasted ~ 2 years

The field test is still going on (2013/2), but so far (after nearly 8 years):
- no significant "failures" observed
- degradation rate seems to be constant
Ongoing: Exposure test in Thailand (NSTDA, IRI, AIST)

Original site (2006-2007): NSTDA Solartec
Moved in 2008
Present site (2008-): PTEC

JSPS 175th Committee
The 4th Thailand-Japan Joint Workshop on Photovoltaics
Bangkok, Thailand
December 8, 2012
Possible annual degradation being observed in Thailand

(since the modules have been exposed outdoors for >2years in prior, initial degradation can be ruled out)

Field test still ongoing at NSTDA, Thailand

JPS 175th Committee
The 4th Thailand-Japan Joint Workshop on Photovoltaics
Bangkok, Thailand
December 8, 2012
What we will need in Japan:

- We definitely need to gather more "failure" data

- Japan has a long experience on commercial deployment of PV systems, but most of them have been residential systems
  - Due to space limitation of rooftops, TF installations have been rare
    - However, they do exist, and some of them do have troubles (next slide)
      Need to collect/analyze data from existing installations

- Recently, both rooftop/ground-mounted installations of TF PV systems are increasing
  - However, almost no public&systematic monitoring systems installed yet
    (This is also going to be a loss from the viewpoint of grid integration)
      Need to install a comprehensive&public monitoring system
There will be more systems waiting for a rescue...

PVResQ! tackling thin-film PV modules now
No experience, no info, no instrument...no solution.

(Kazuhiko Kato, PVMRW 2012)
Summary:

- Current TF-Si technologies can maintain degradation rate of below 1%/year after stabilization
- Light soaking at low temperatures may help to estimate long-term performance of TF Si modules
- Disconnection of internal wiring reported in TF-Si modules
- To stabilize the performance outdoors, 2 years were required for some a-Si and CIGS modules

- Need to collect/analyze more data from existing installations
- Need for nationwide monitoring systems
  - for deployment of a more reliable, cost-effective PV systems (it should be possible with the technologies we have today)

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