High PID resistant cross-linked encapsulant based on polyolefin SOLAR ASCE™

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Motivation %

- ✓ In PV modules, cross-linked EVA encapsulant is commonly used because it has its transparency, thermal creep resistance, proven long term reliability on the field exposure over 20 years
- ✓ To address PID issue, high insulation encapsulant is one of the solutions
- ✓ Thermoplastic polyolefin encapsulant show better insulation property than EVA, but there are some concern about thermal creep resistance
- ✓ We have developed new polyolefin encapsulant "SOLAR ASCE™", which is based on high electrical resistivity polyolefin resin and is cross-linked during % lamination like EVA encapsulant %

Scheme of designing New PO encapsulant

Mitsui Chemicals Group

2) Developing material design

Adhesive property

Long term reliability

Thermal property

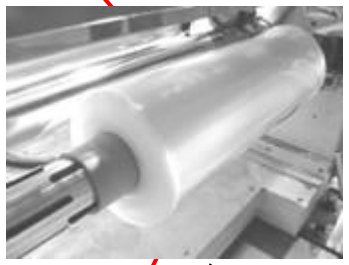
Chemical property

Electrical property

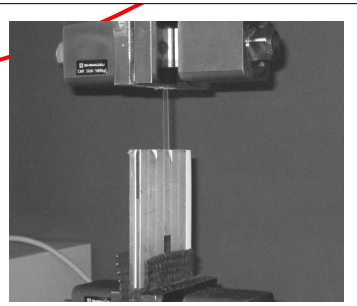
Mechanical property

1) Raw material

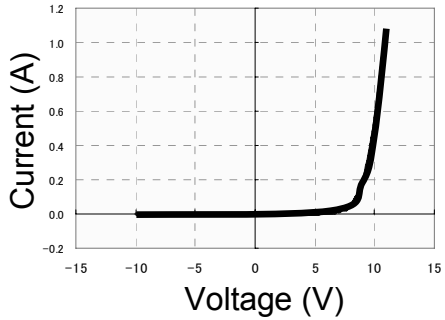
3) Sheeting



4) Checking material property

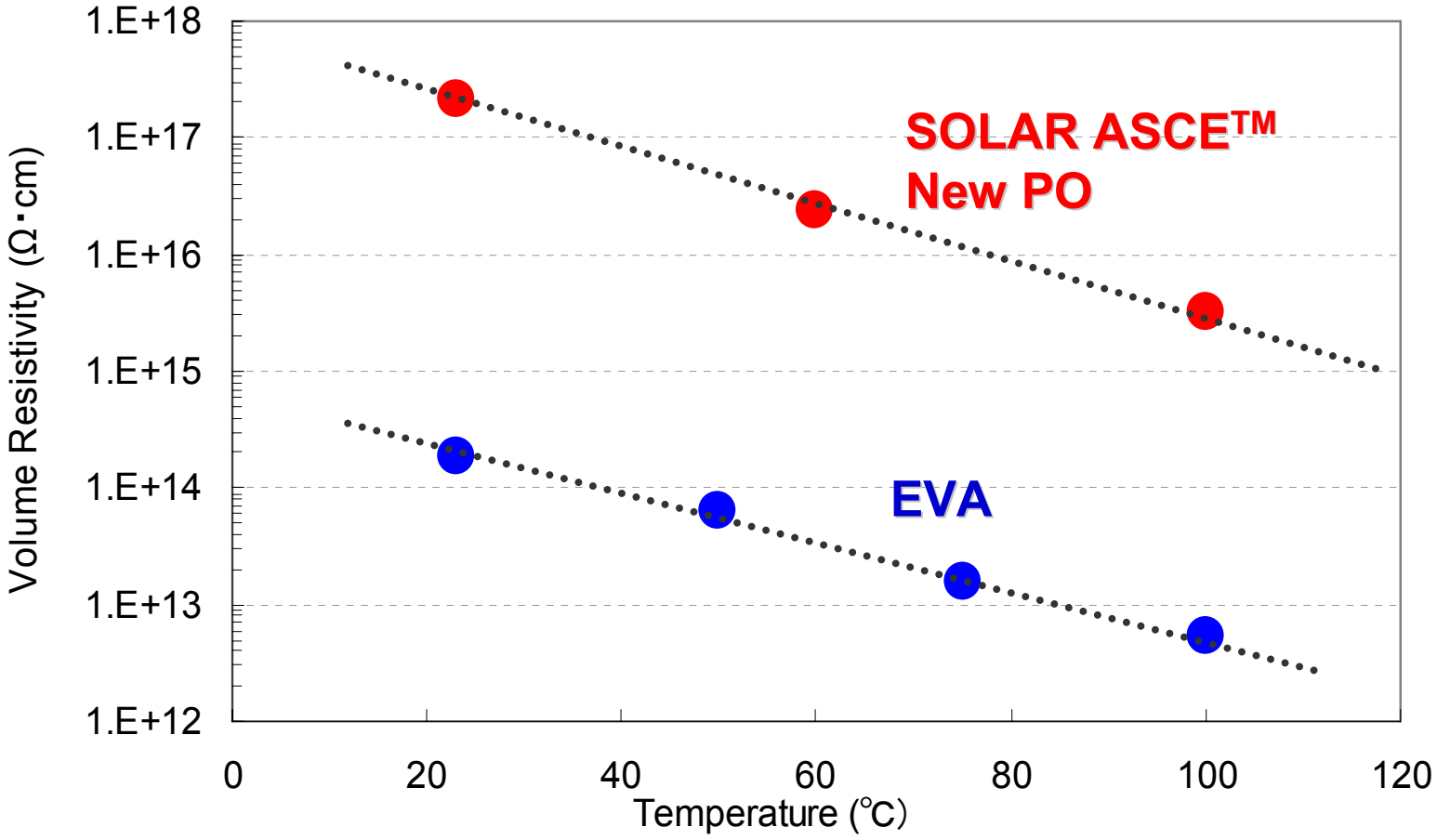


5) Electrical evaluation



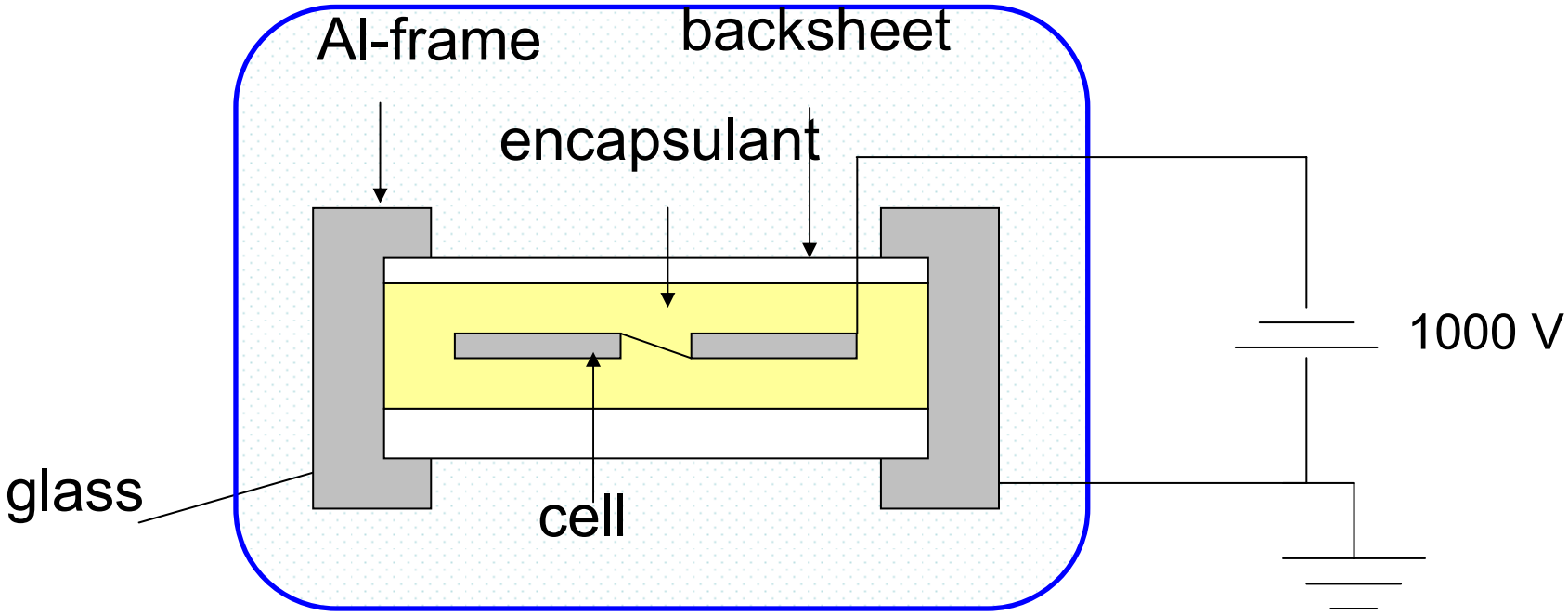
Feed-back

Volume Resistivity %



PID acceleration tests method %

Damp heat chamber %



Test conditions

Cell :single cell or full module

Exposure time : 96h - 240hr

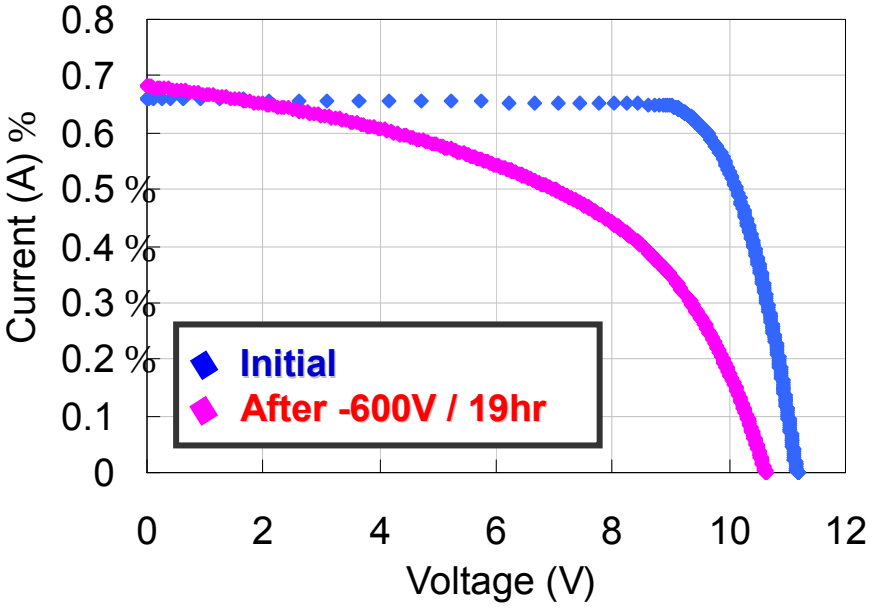
Voltage : -600V or -1000V

Temp. : 60^0C85% or 85^0C85%

Cell selection by PID test with conventional EVA

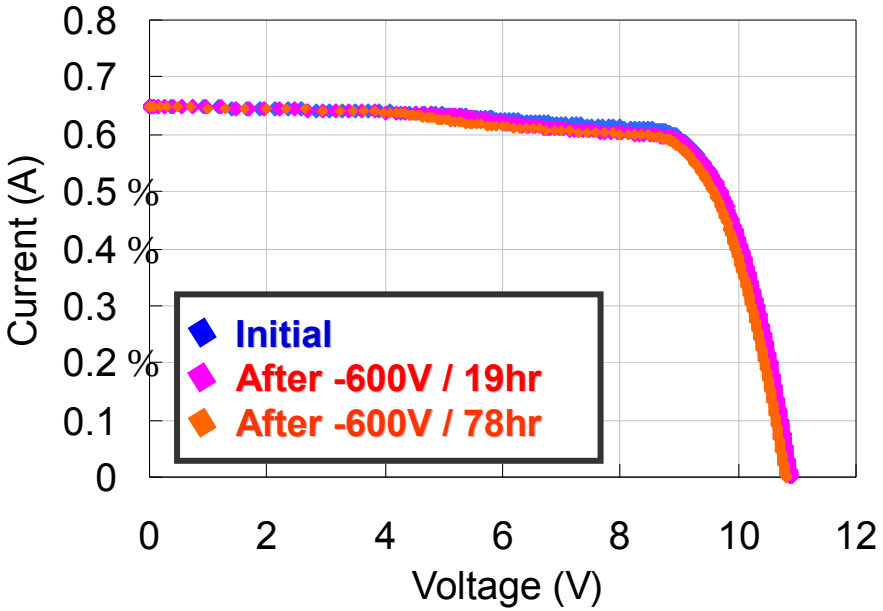
EVA with PID-prone cell (60oC85%RH,-600V)

Power loss : 40%



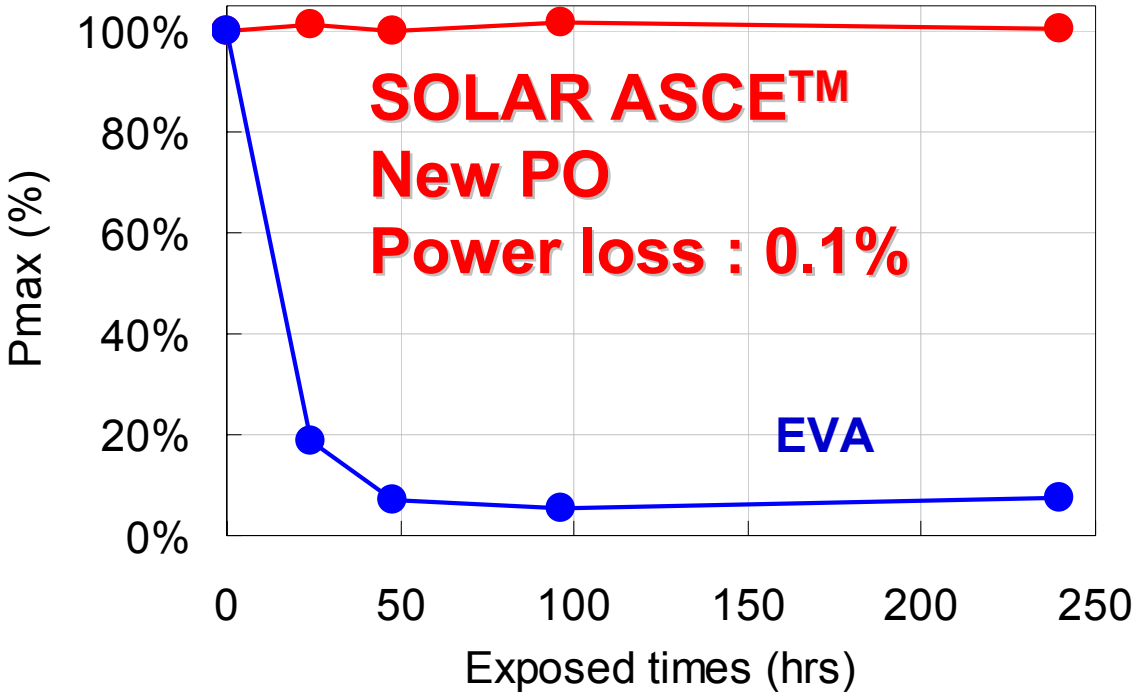
EVA with PID-durable cell (60°C85%RH,-600V)

Power loss : 2%



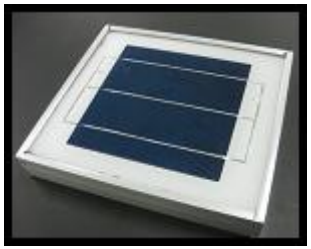
We have chose PID prone cells to evaluate SOLAR ASCE™

PID durability of New PO %



PID test condition

- Module
  1Cell, 6inch multi-crystalline
  (PID sensitive sell)



- 85°C85% -1000V

Measurement of Pmax
Irradiance : 1000W/m2

PID durability of New PO %

60 cells full module PID test with various encapsulant %

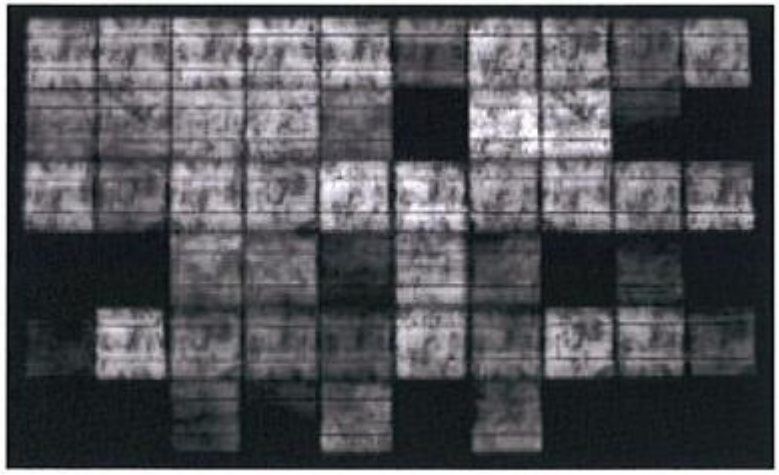
PID condition	SOLAR ASCE™ New PO	EVA
60℃85% -1000V 96hr	-1%	-75%
85℃85% -1000V 48hr	-1%	-80%

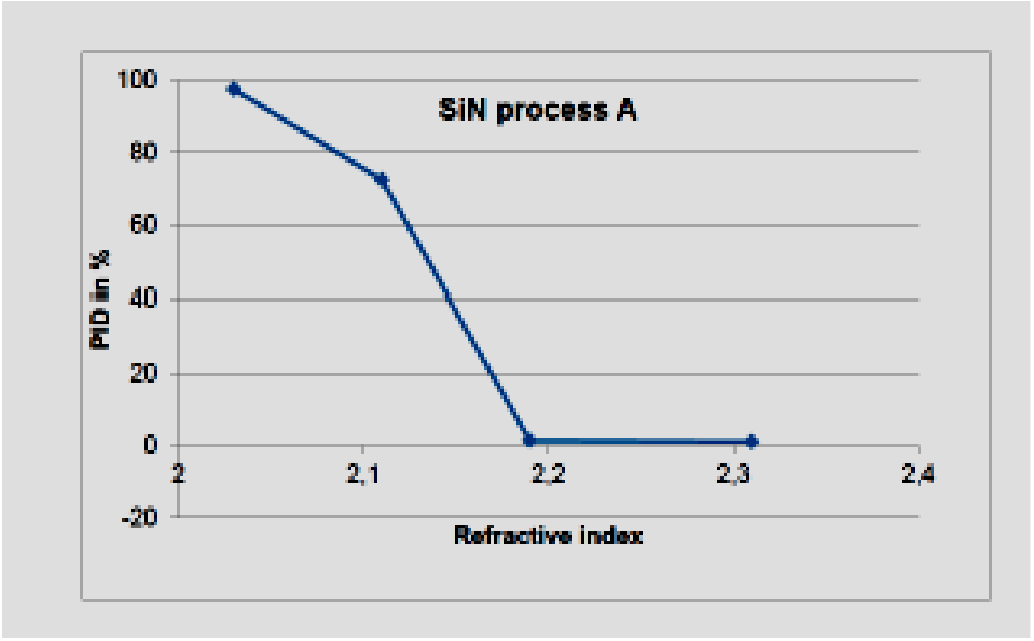
PID test module %
60Cells (6x10cells) %

SOLAR ASCE™
REAL PID FREE

Cell quality effect on PID %

Electroluminescence image of
PID occurred module





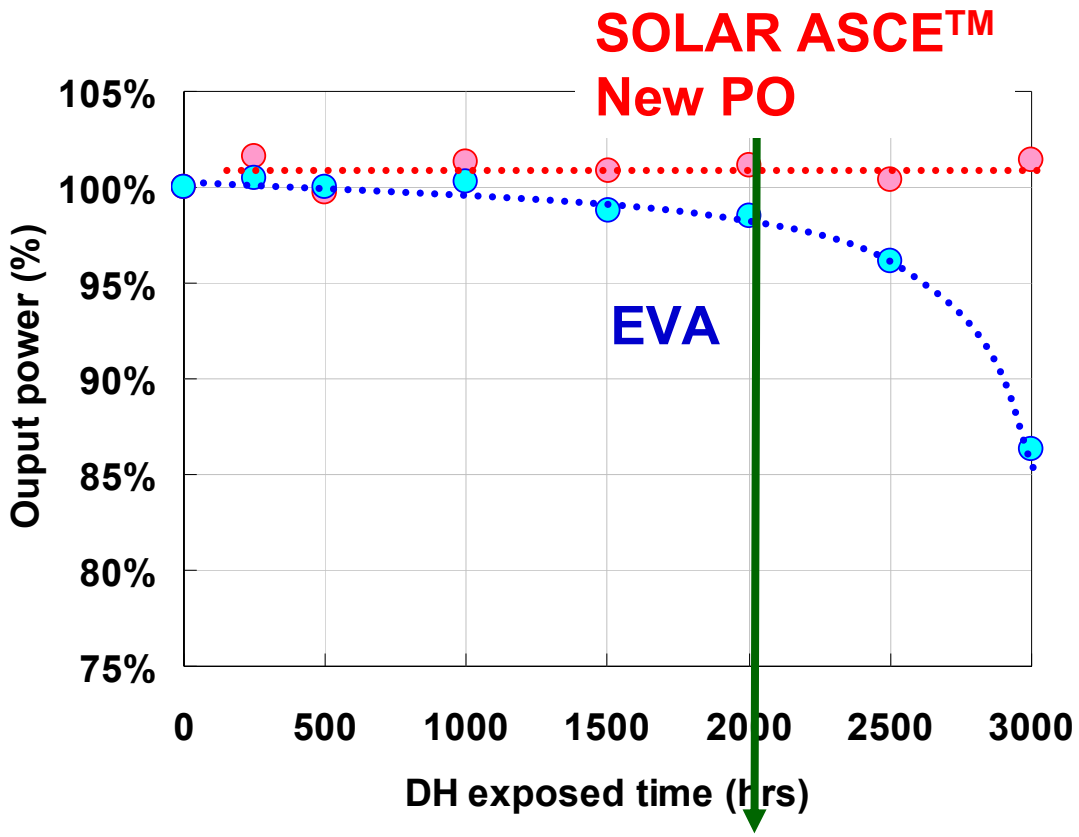
Reflective Index of AR-coating affects PID degradation

The data above was published at SOLON SE

9 %

Damp heat durability of New PO %

DH test of 36cells full module &



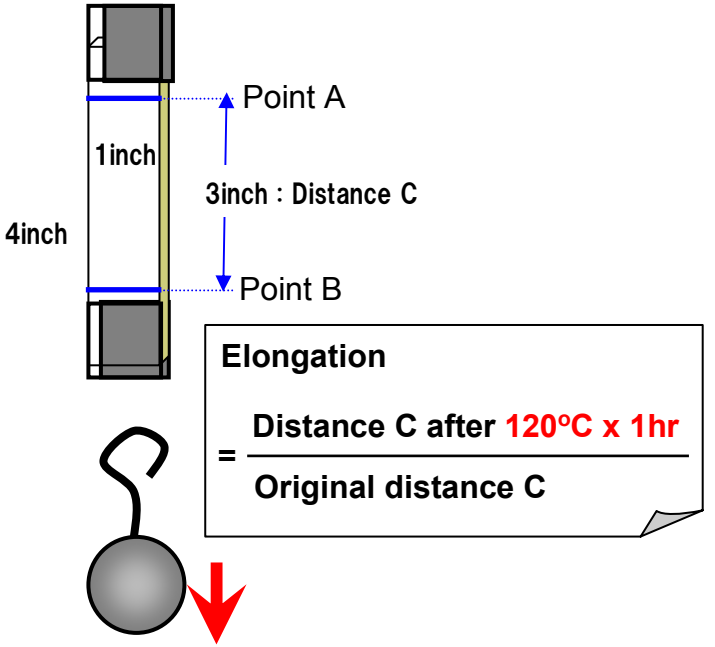
2000 hr: generally recognized as the equivalent to 20 years in the field

**** Mono-Crystalline module (36Cell,1200mm ×527mm)***

Thermal creep stability %

Elongation of encapsulant at 120°C

		3000Pa	100Pa
SOLAR ASCE™ New PO	Cured	13%	0%
EVA	Cured	17%	0%
Thermoplastic PO encapsulant	Non-Cure	217%	12%



3000 or 100 Pa x 120°C x 1hr %

Thermal Creep property is improved by curing

Summary %

- ✓ PID failure occurs on high temperature, high humidity and high negative voltage on modules
- ✓ PID failure depends on Cell quality, especially reflective index of AR-coating
- ✓ Our New PO encapsulant ,SOLAR ASCE™, shows prominent PID improvement effect and expanding diversity of cell choices
- ✓ Cross-linking of New PO improve thermal creep stability just as good as cross-linked EVA encapsulant