2020 Study results

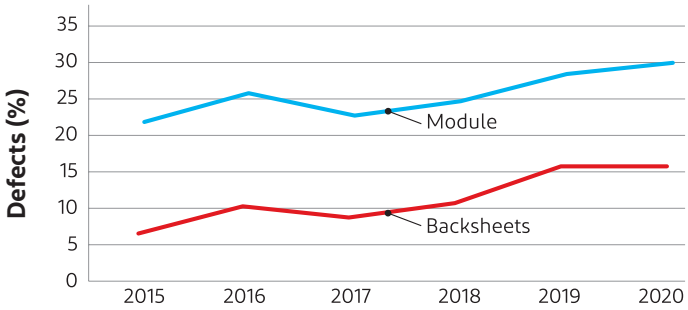
Inspection observations based on 3GW of fields:

- Total module defects: 30%
- Total backsheet defects: 16%
- Total cell/interconnect defects: 14%
- Cracking comprises 64% of all backsheet defects

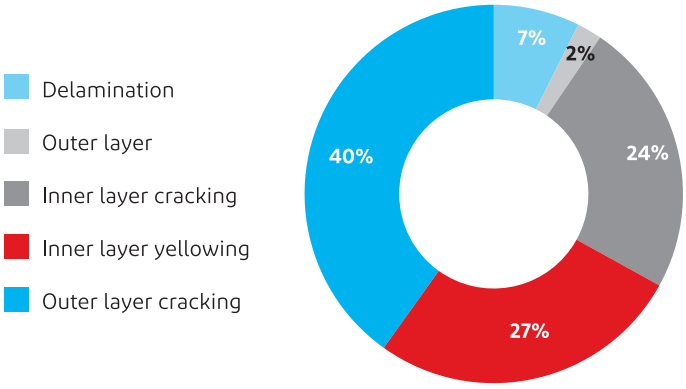
Module defect types

- Backsheet: outer-layer (air side) and inner-layer (cell side) cracking, delamination, yellowing
- Cell/interconnect: corrosion, hot spot, snail trails, broken interconnect, cracks, burn marks
- Encapsulant: discoloration, browning, delamination
- Other: glass defects, loss of anti-reflective (AR) coating, junction box

Defect trends



Backsheet defects by degradation mode



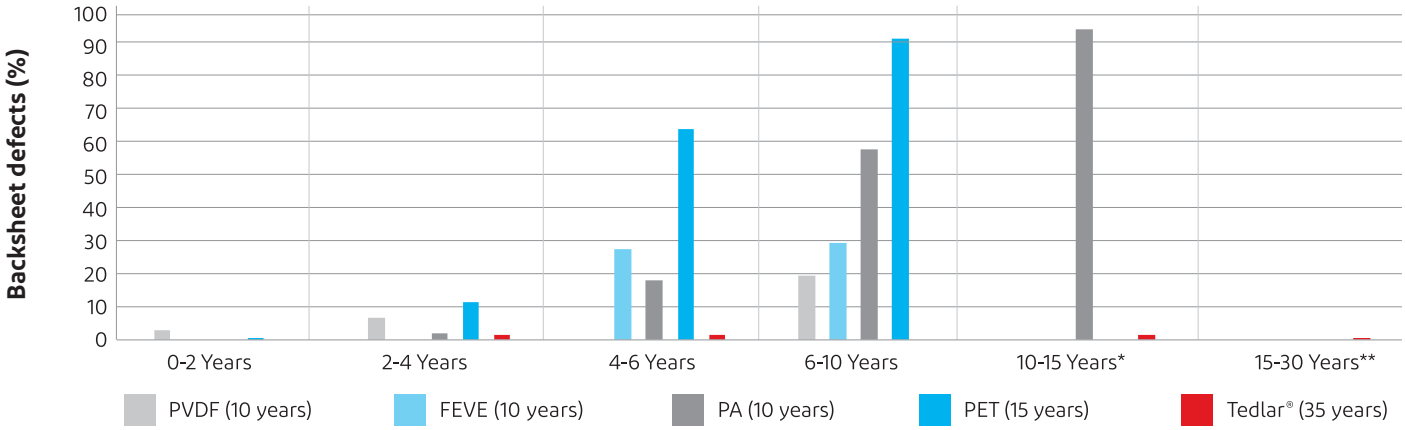
Emerging trends in backsheet failures

- Rapid increase in cracking in polyvinylidene fluoride (PVDF) backsheets
- Cracking of inner layers
- Delamination in double glass modules
- The overall PVDF outer layer cracking rate increased more than 3x
- The overall inner layer cracking rate tripled

Backsheet defect rates

DuPont™ Tedlar® polyvinyl fluoride (PVF) film-based backsheet maintains the lowest defect rates—even after 35 years in the field.

Defect rates in PVDF, FEVE, PA, PET and Tedlar® backsheets



PA = Polyamide
PET = Polyethylene terephthalate

PVDF = Polyvinylidene fluoride
FEVE = Fluoroethylene vinyl ether

*No PVDF, FEVE or PA backsheets in this age range exist in the field.

**No PVDF, FEVE, PA or PET backsheets in this age range exist in the field.

Backsheet field study key findings

2019 vs. 2020 overall findings

PVDF outer-layer cracking defect rates have increased more than 3x in the past year.

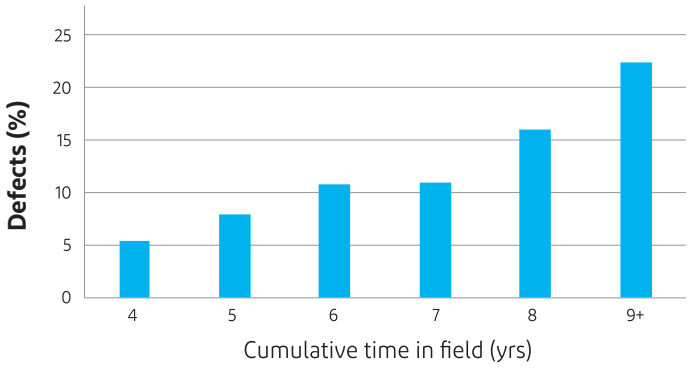
PVDF cracking in China, Europe, India, and North America

There is no clear correlation between cracking and climate because cracking has been observed in hot-arid, cold-arid, temperate, and Mediterranean regions.

Rapid increase of cracking in PVDF backsheets

There has been observed nearly a four-fold cumulative increase in PVDF outer-layer cracking defect rates, from 5% to 23% between year 4 and year 9 after installation.

PVDF backsheet cracking defect rate



Material defects

PVDF backsheet cracking

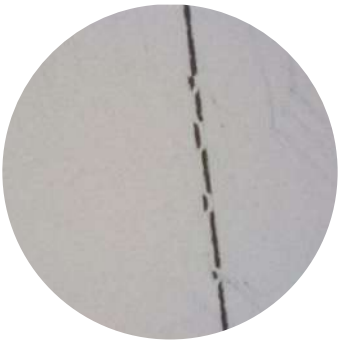
There have been observed many examples of widespread backsheet through-cracks.

• These failures are prevalent along busbar ribbons, but with continued weathering can extend to cell gaps and other regions.

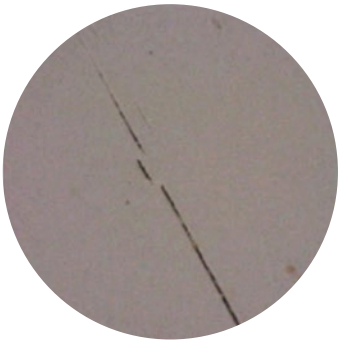
• Arcing and shorts often lead to localized burn-through and sometimes full module fires.

• Reported inverter tripping and ground faults.

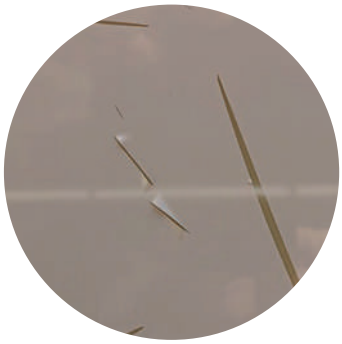
5 years
Eastern Canada



6 years
Qinghai, China



6 years
Xinjiang, China

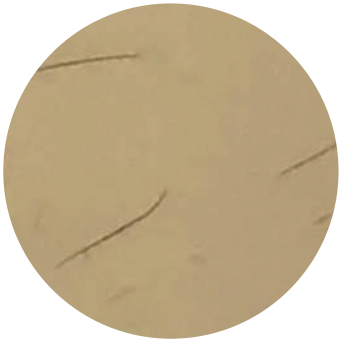


7 years
SW USA

8.5 years
Veneto, Italy

9 years
Apulia, Italy

9 years
Gujarat, India



9 years
Telangana, India