MATERIALS MATTER: IMPACT OF MODULE MATERIALS ON METALLIZATION AND INTERCONNECTION

13th Metallization and Interconnection Workshop

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DOW AT A GLANCE

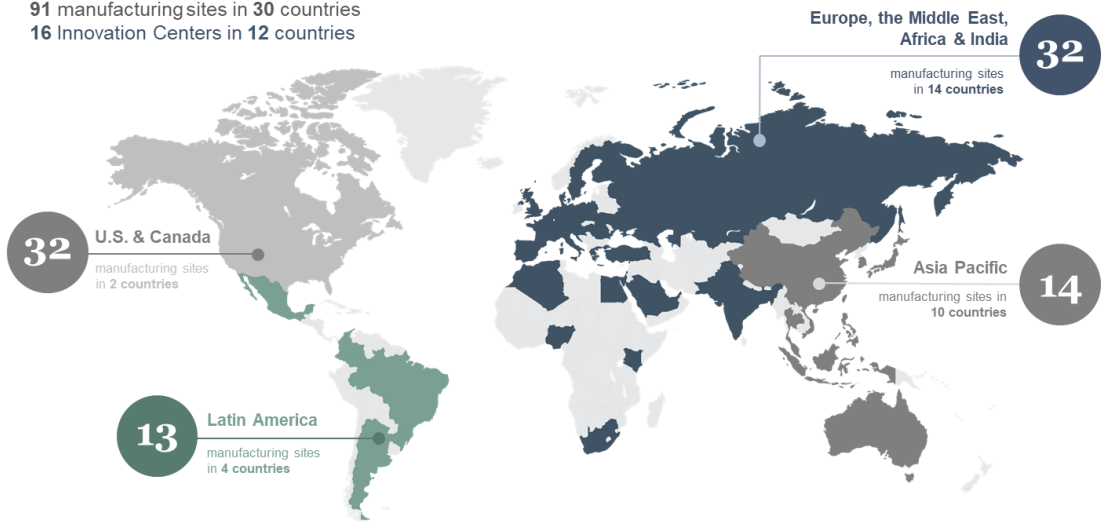
Every answer starts with asking the right question.

At Dow, these questions and the pursuit of solutions for the world's toughest challenges inspire us to collaborate and use our materials science experience to create innovative solutions that transform our world and offer a sustainable future.

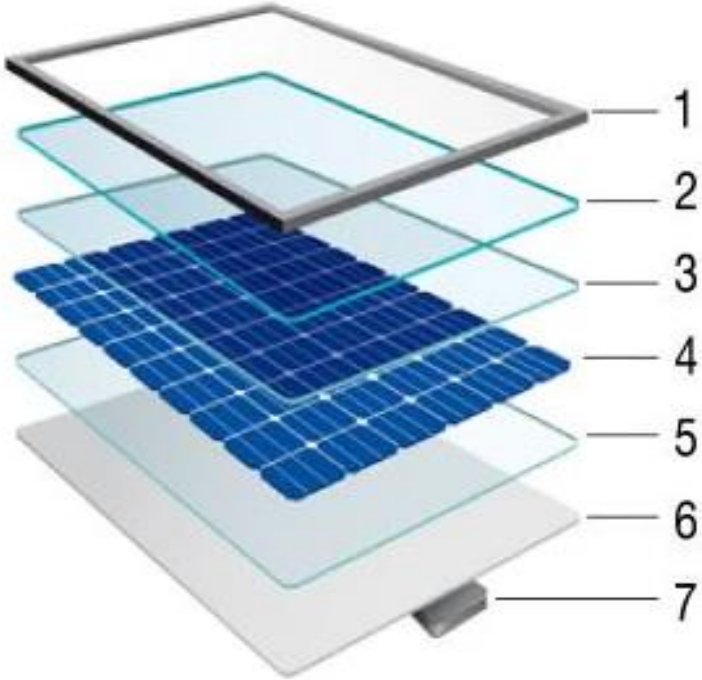
$43B	~36,000	91	30
net sales in 2024[1]	employees	manufacturing sites	countries in which Dow manufactures products

PACKAGING	INFRASTRUCTURE	CONSUMER	MOBILITY
~30%	~40%	~20%	~10%

91 manufacturing sites in **30** countries
16 Innovation Centers in **12** countries



DOW MATERIALS FOR PHOTOVOLTAICS

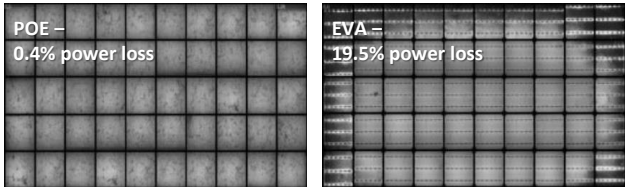


1. **Frame or rails:** DOWSIL™ frame sealants and rail bonding adhesives
2. **Glass**
3. **Encapsulant:** ENGAGE™ PV and DOWSIL™ encapsulants
4. **Cells**
5. **Encapsulant:** ENGAGE™ PV and DOWSIL™ encapsulants
6. **Backsheet:** DOWSIL™ coatings
7. **Junction box/power optimizer/microinverter:** DOWSIL™ adhesives, potting agents, and electronics encapsulants

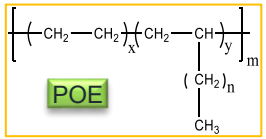
ENCAPSULANT DURABILITY: KEY PROPERTIES

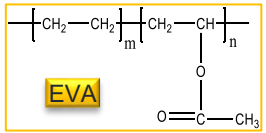
ENGAGE™ PV POE from Dow has strong value over EVA in helping to achieve bifacial module reliability:

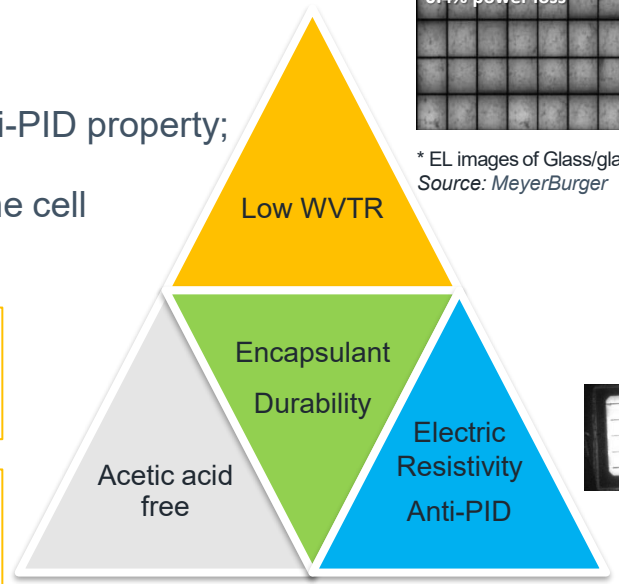
- High moisture barrier, low WVTR;
- Good electrical insulation and anti-PID property;
- No acetic acid in POE, address the cell corrosion problem.

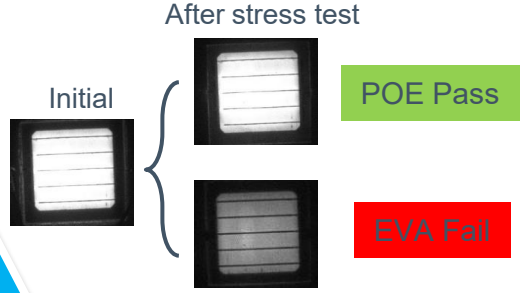


* EL images of Glass/glass module after aging at DH for 7000 hours
Source: MeyerBurger





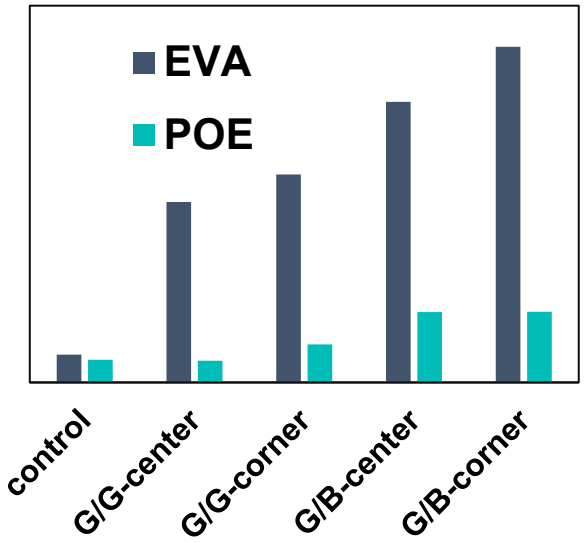




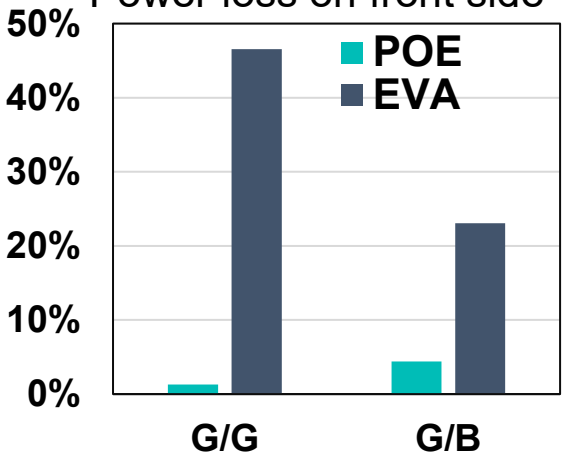
EL image
bright if cells are good,
dark if cells are damaged.

THE BENEFIT OF POE LOW WVTR FOR TOPCON MODULES

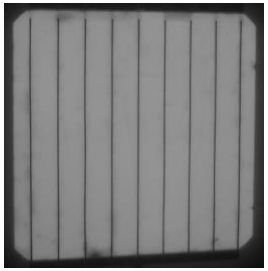
Water ingression for modules after 8 weeks DH aging



Power loss on front side

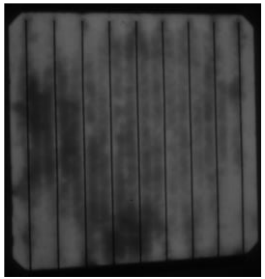


EL images after 8 weeks DH aging

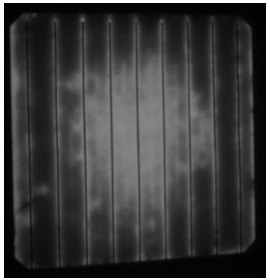


G/B-POE

G/G-POE



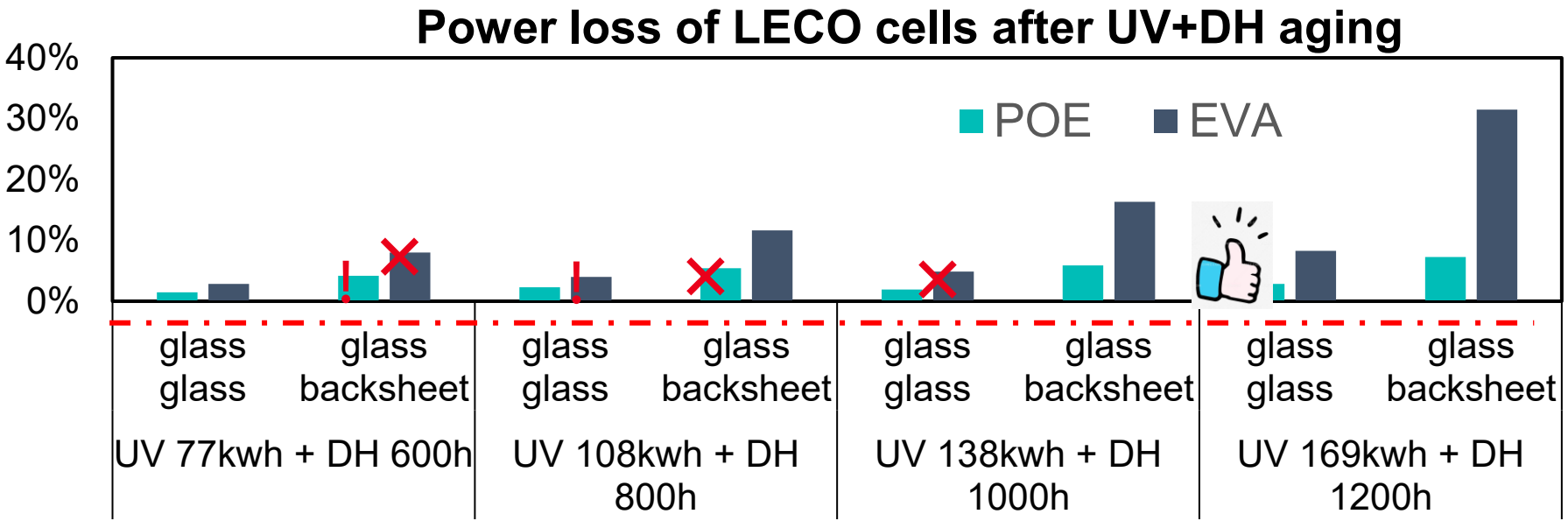
G/B-EVA



G/G-EVA

- Higher content of moisture could be detected in EVA encapsulated modules;
- Good power output maintenance in POE encapsulated modules;
- Extreme power loss in EVA encapsulated modules;
- G/G modules could trap the corrosive products, leads to worse corrosion behavior comparing with G/B.

CORROSION REMAINS CRITICAL FOR TOPCON-LECO CELLS

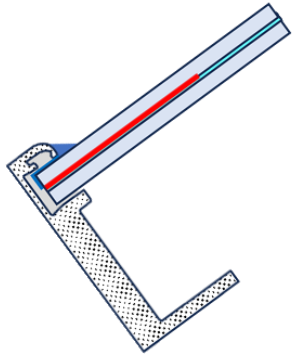


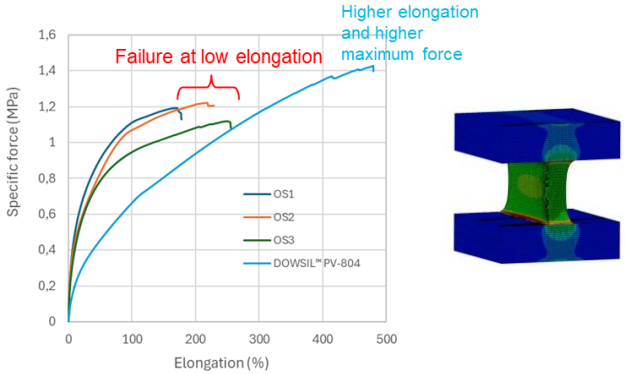
UV+DH aging on LECO cells:

- UV+DH as comprehensive environmental aging test is more in line with actual outdoor use;
- **For both glass glass and glass backsheet modules, POE+POE performs more reliably than EVA+EVA;**

IMPACT OF FRAME SEALANT ON CORROSION

- Water often remain at lower edge of module for significant time
- Loss of sealant adhesion → water penetrates down to encapsulant → reacts with chemical bonds between glass and encapsulant → delamination → corrosion and loss of insulation
- Performance of sealants under complex stress situations varies a lot





	First campaign, glass-Al		2nd campaign, Al-Al	
	F_{max} (MPa)	Elongation at F_{max} (%)	F_{max} (MPa)	Elongation at F_{max} (%)
Oxime Sealant 1	1.20	72	1.20	157
Oxime Sealant 2	0.59	126	1.22	203
Oxime Sealant 3	1.18	101	1.14	243
DOWSIL™ PV-804 Neutral Sealant	1.3	489	1.45	478

CONCLUSIONS

- Polymeric module materials have a large impact on the reliability of PV modules, often through better protection against corrosion of metallization and interconnection
- Materials need to be selected carefully for long-term high performance
- Small immediate savings on materials can lead to major problems in the field
- It is important to look beyond IEC certification
- Watch PV Magazine webinar replay: Mitigating risk in solar projects: The power of a reliable bill of materials – pv magazine International

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