

FLEXOSKIN® - Front Barrier Film for Flexible Solar Modules

BL – High Performance Polymers



EVONIK
INDUSTRIES

Introduction

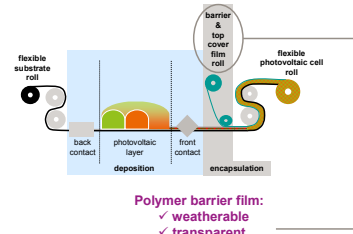
- Transparency
- Barrier
- Weatherability



These are the most important properties a front sheet should provide for flexible thin-film photovoltaics.

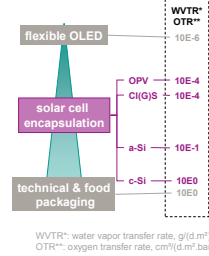
With FLEXOSKIN®, Evonik presents a new barrier film for flexible solar modules.

Future developments will have to provide a cost efficient roll-to-roll process.

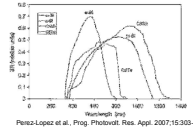


The polymer film has to fulfill special requirements

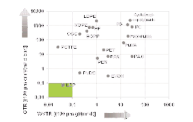
Barrier requirements



Transparency requirements



Barrier properties of polymers

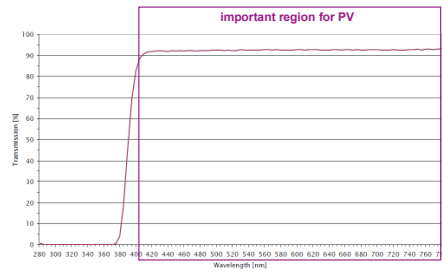


FLEXOSKIN® provides properties by material combination

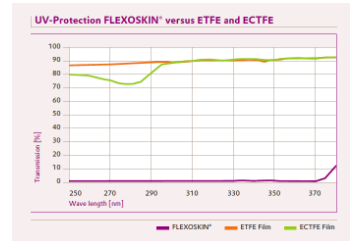
weatherable layer (PMMA based*)	<p>*) Advantages of PMMA:</p> <ul style="list-style-type: none"> • outstanding weatherability • very high transparency • no haze • high surface hardness • good heat resistance • good chemical resistance • chemically recyclable
pre barrier layer	
main barrier layer	
special adhesive	
PV module	

ACRYLITE®
Naturally UV-Stable

Perfect Transparency of PMMA for Solar Cells



Perfect UV protection for the encapsulating material and other polymers in the module.



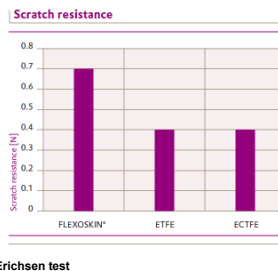
Barrier Properties of FLEXOSKIN®

Target: 0.0001 g/(m² d)

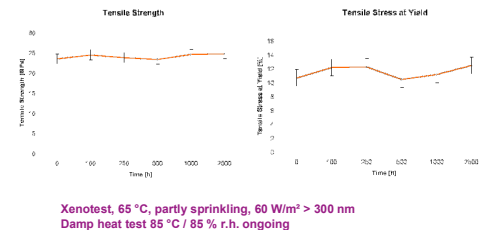
weatherable layer	pre barrier layer	main barrier layer	
20	1	< 0,001	WVTR g/(m² d) @ 38°C, 85 % r.h.

stable for 1000 hrs, test continued up to + 3000 hrs

FLEXOSKIN® provides excellent Scratch Resistance



Mechanical Properties remain after Aging



Further Properties of FLEXOSKIN®

material properties	specification value
Adhesion to EVA-fc [N/cm]	20
Partial discharge voltage [V]	> 1000
Film thickness [µm]	300 – 350
Film width [mm]	300 – 1200

Solar module testing according to IEC 61646 - in progress

preconditioning 5kWh/m²	temp. Coefficient; NOCT; performance @ STC, NOCT; performance @ low irradiance, outdoor exposure test 60 kWh/m², bypass diode thermal test; hot-spot endurance test
visual inspection;	UV preconditioning test 15kWh/m²; thermal cycling test, 50 cycles -40°C → 85°C; humidity freeze test 10 cycles -40°C → 85°C, 85% RH; robustness of terminations test
max. power determination	
insulation test	thermal cycling test 200 cycles 40°C → 85°C
wet leakage current test	damp heat test 1000 h, 85°C, 85% RH; wet leakage current test, mechanical load test; hail test;

Summary & Future Work

- FLEXOSKIN® provides properties necessary for flexible PV
- FLEXOSKIN® combines weatherability, transparency and barrier
- Long term durability tests are ongoing
- Module Testing ist running with FLEXOSKIN®