

Water Cooking for Backsheet and PV Module Endurance

Maoyi Chang, Haomin Chen, Chienyu Chen, C. H. Hsueh and W. J. Hsieh

AU Optronics

No.1 JhongKe Rd, Taichung, 40763, Taiwan

Introduction & Objectives

- Water cooking is applied as an efficient screening tool to evaluate various structures of PV module backsheet from three suppliers against thermal and humidity stressing. Visual check, adhesion, yellowing, water vapor transmission rate (WVTR) and FT-IR spectral are inspected. De-lamination among layers and PET hydrolysis occur after 600 ~800 hours.
- Comparing with extended damp heat reliability in P-mono modules, it has well correlation between water cooking to damp heat result. The acceleration factor is around 6 to 8 times faster than damp heat test.

Experiment

For water cooking test, de-ionized water (the resistivity > 18 M Ω -cm, at 25°C) in 6-liter beaker is heated on a temperature programmable hot plate. Water temperature is controlled within 100°C \pm 2°C.

Backsheet Type	A	B	C
Outer Layer (Air side)	PET(50um)	PVDF(20um)	PET(50um)
Adhesive			
Middle Layer (Insulation Layer)	PET(125um)	PET(125um)	PET(125um)
Adhesive			
Inner Layer (Cell side)	Primer(100um)	EL(150)	EVA(100um)

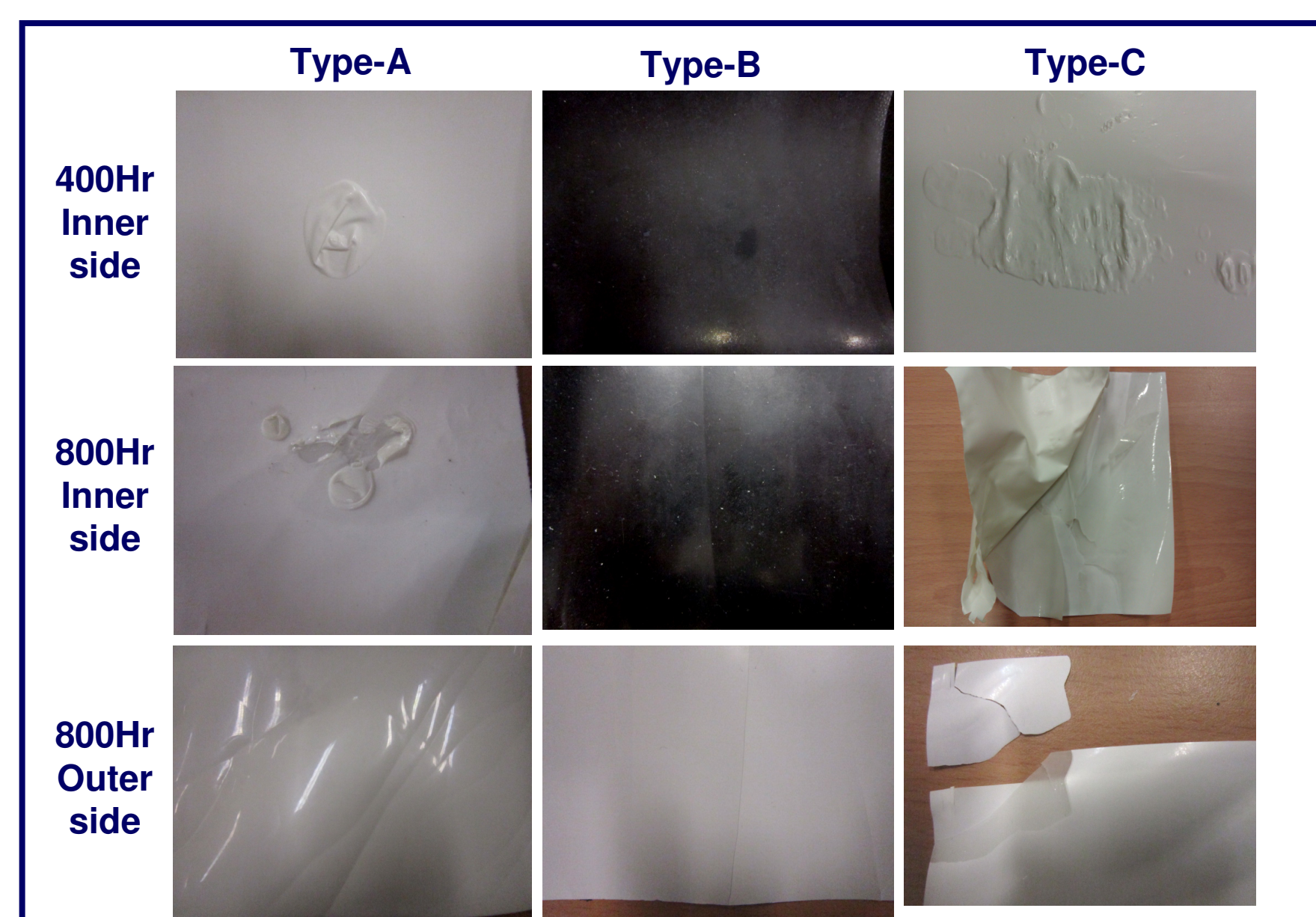
Layer structure of backsheets



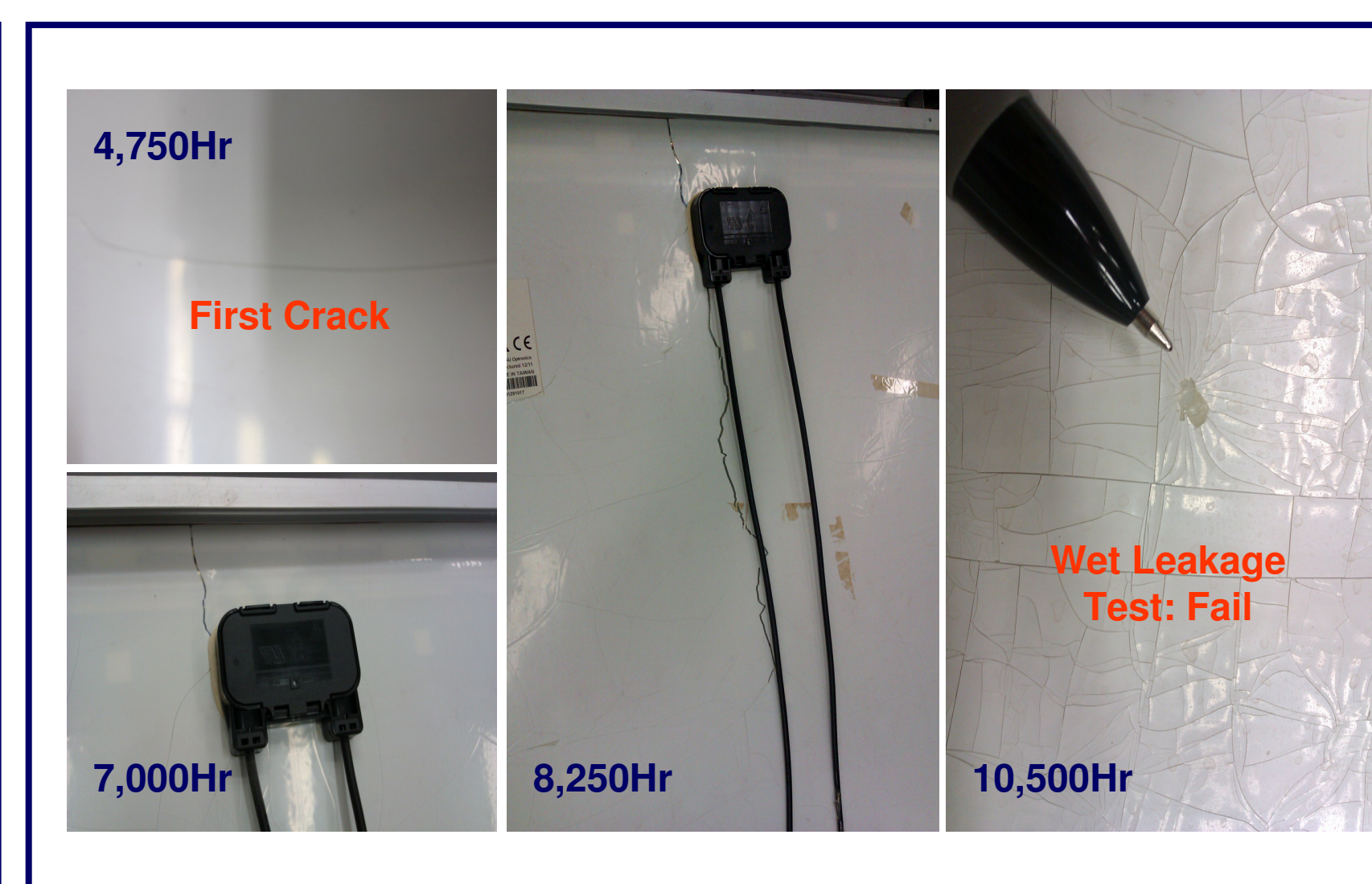
Setup for water cooking test

Results

Visual Appearance after Water Cooking and Damp Heat

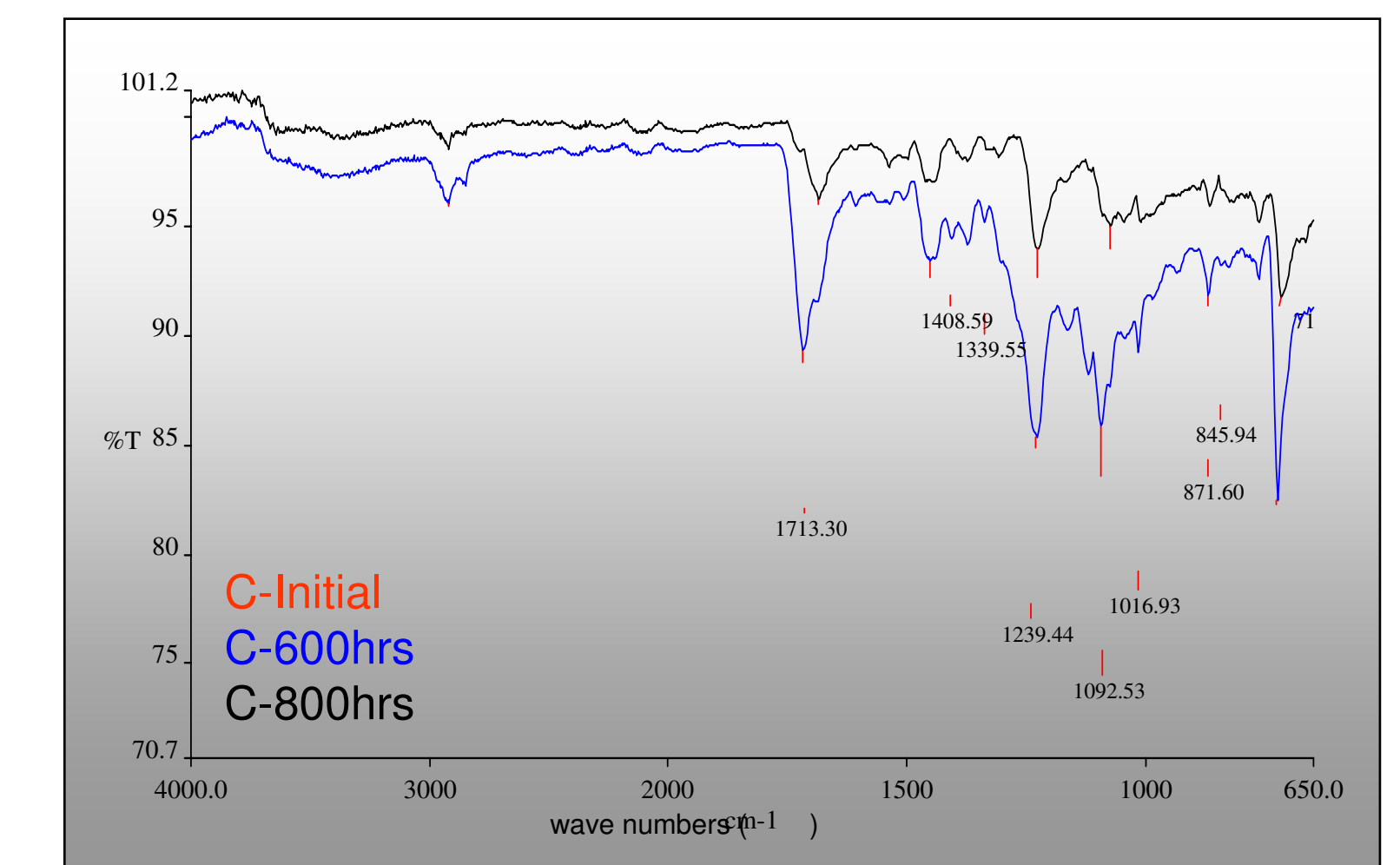
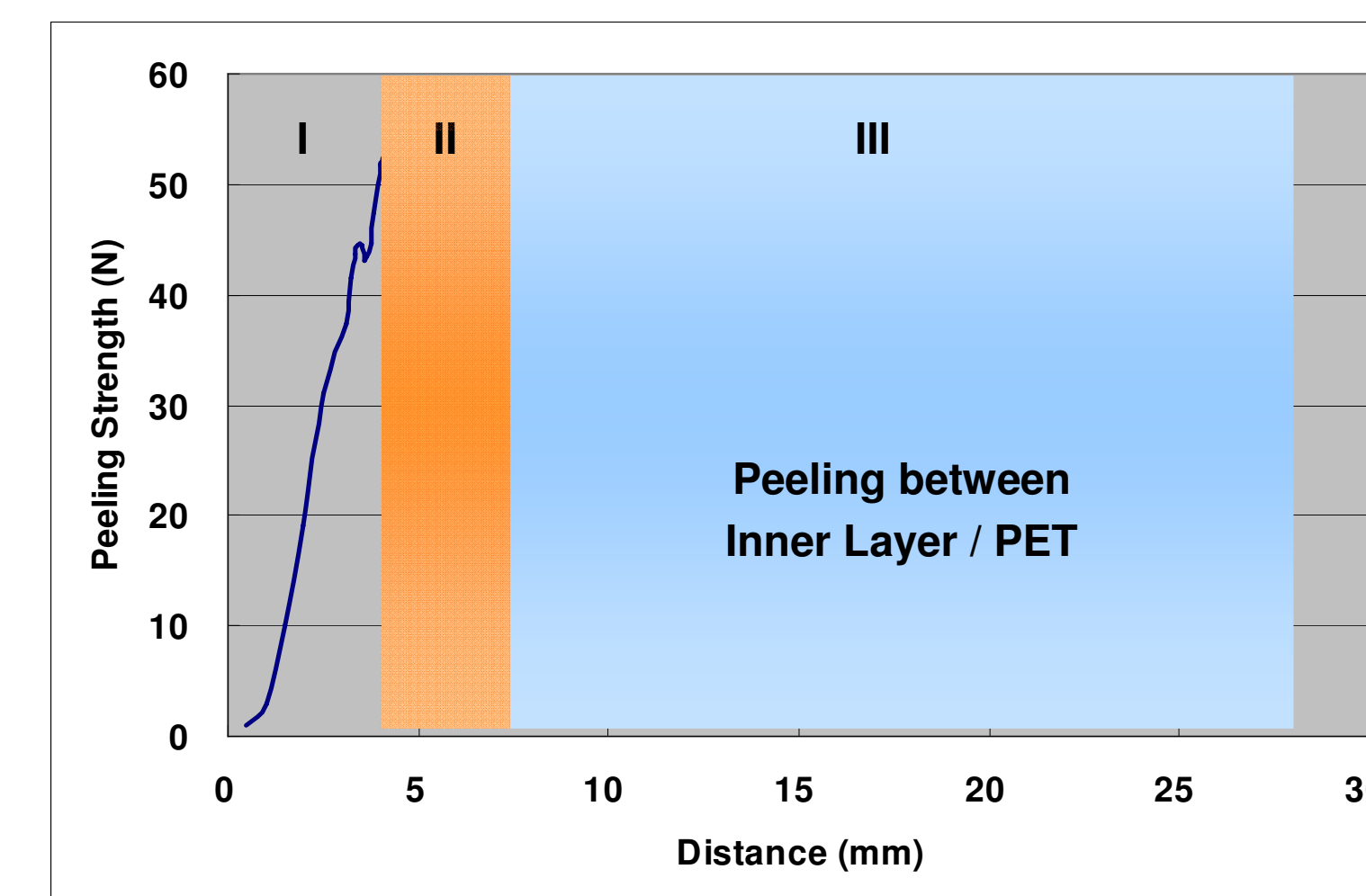


The endurance for water cooking : type-A > type-B > type-C.

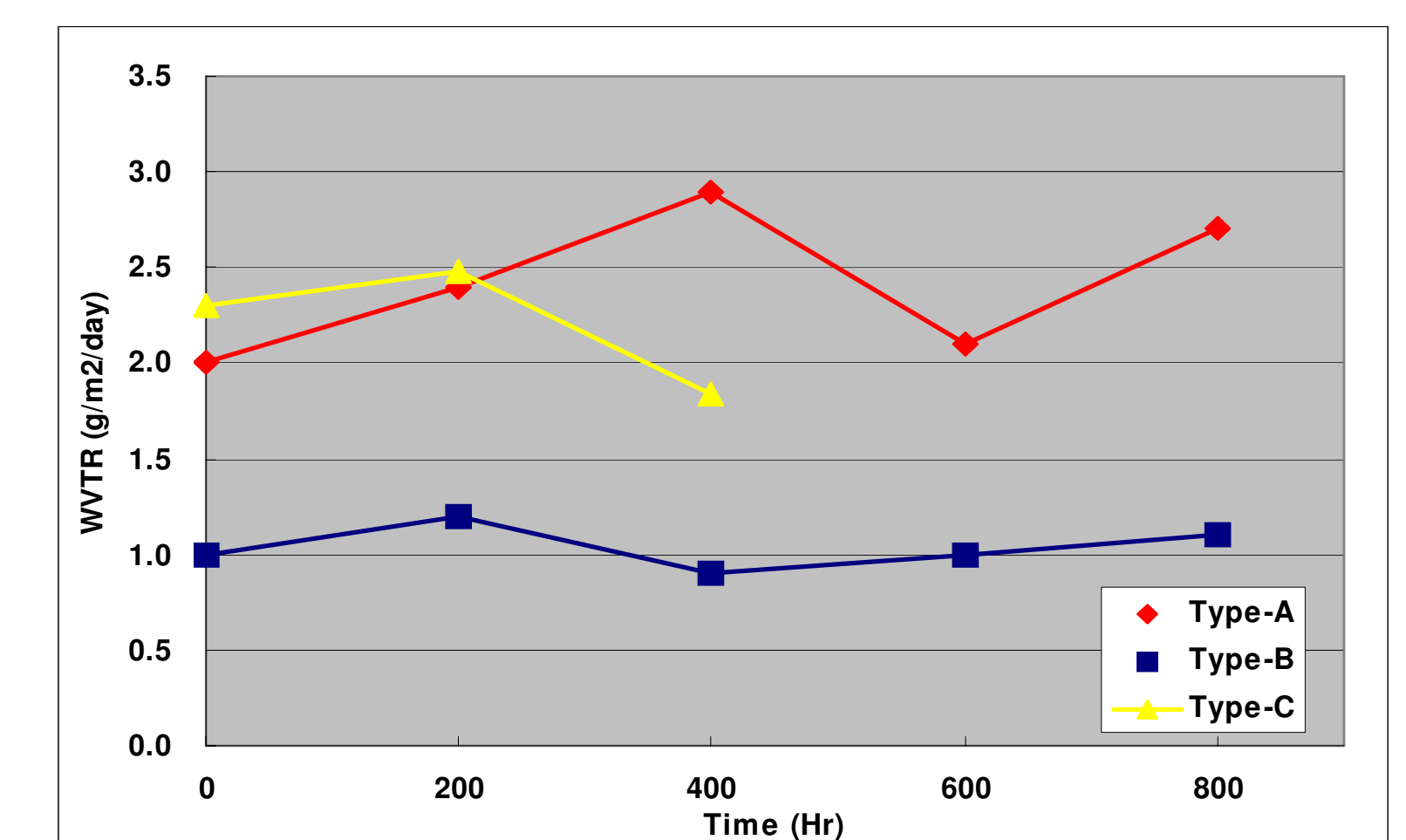
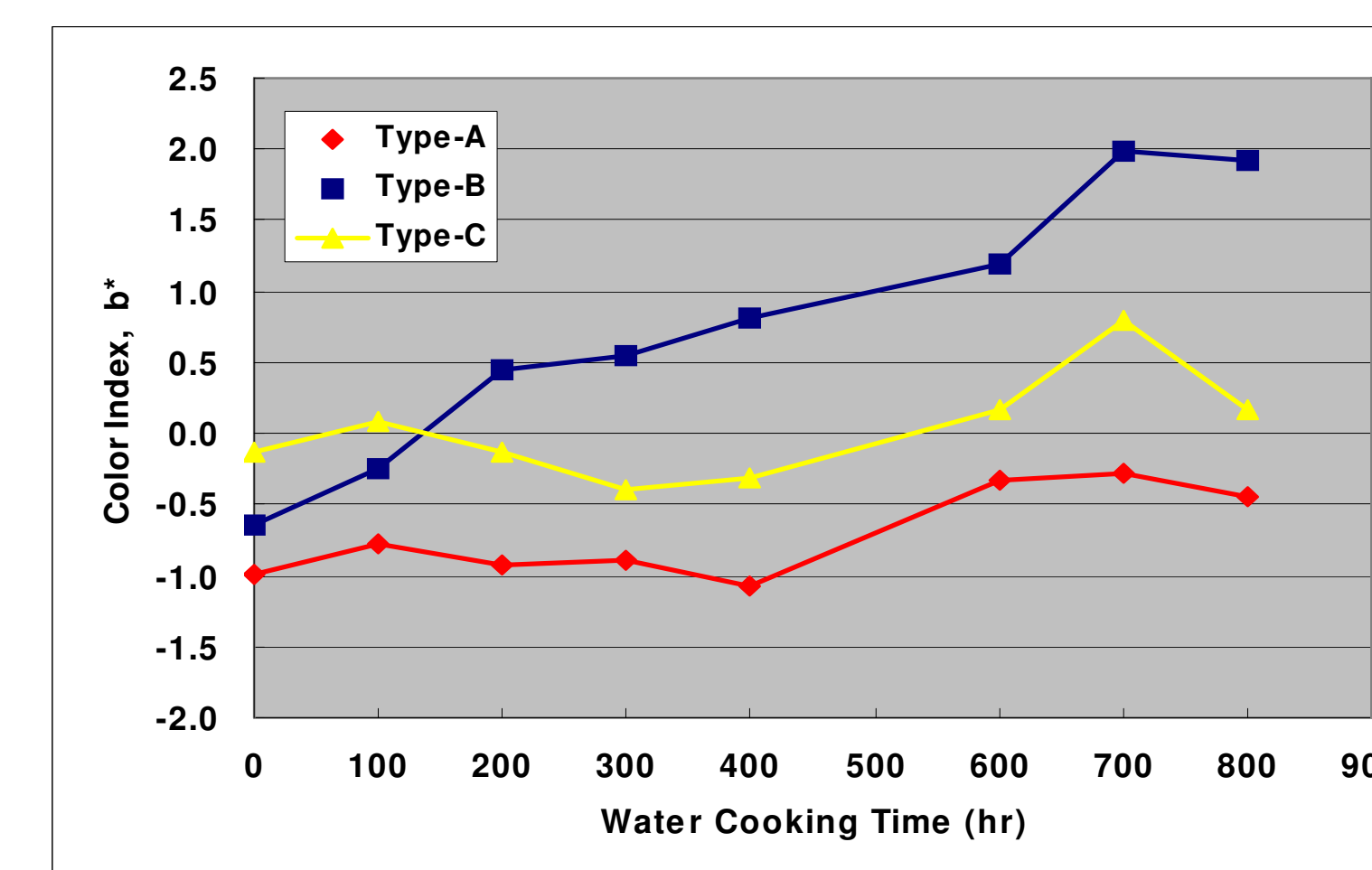


Type-A backsheet module after ware-out damp heat test

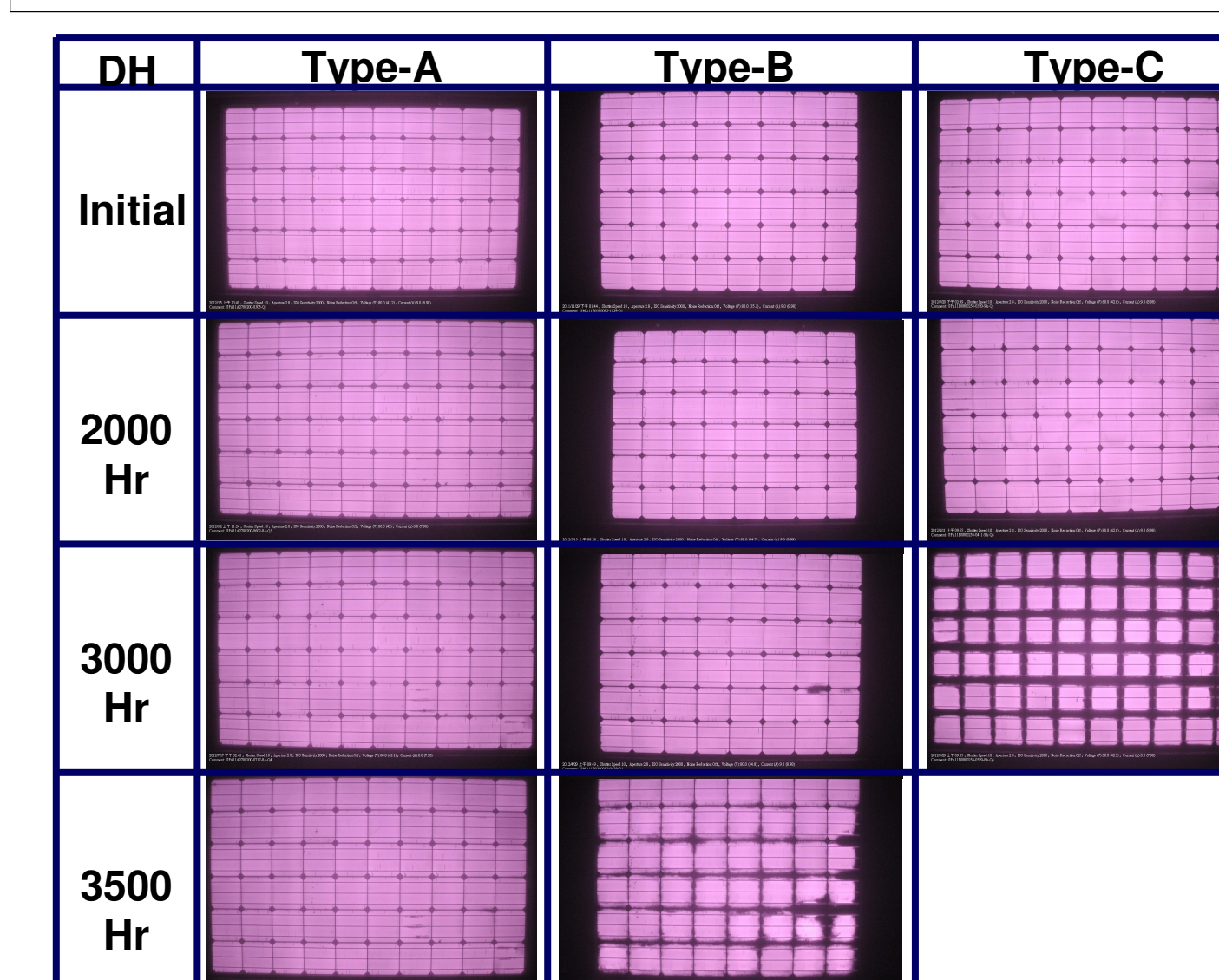
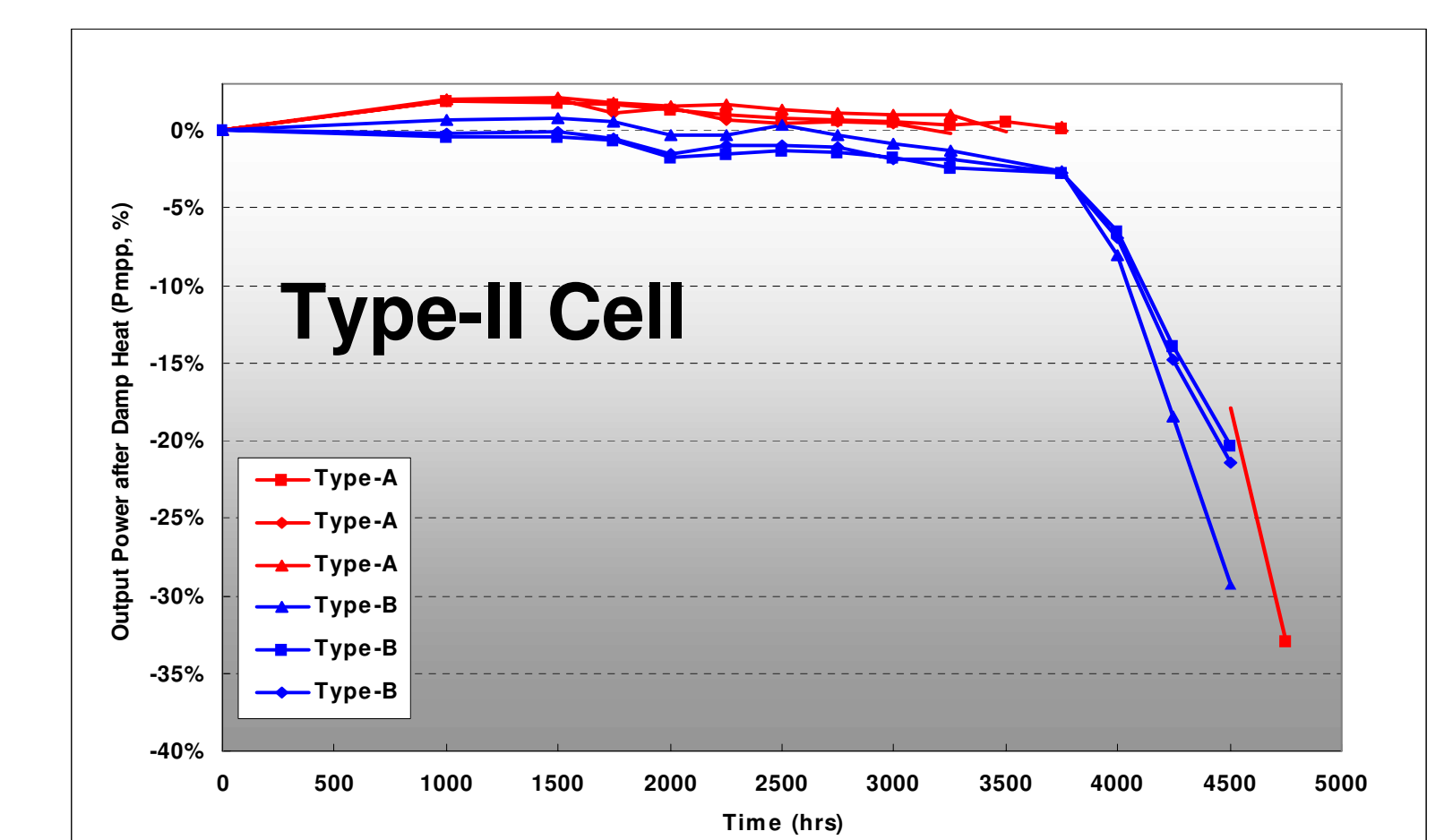
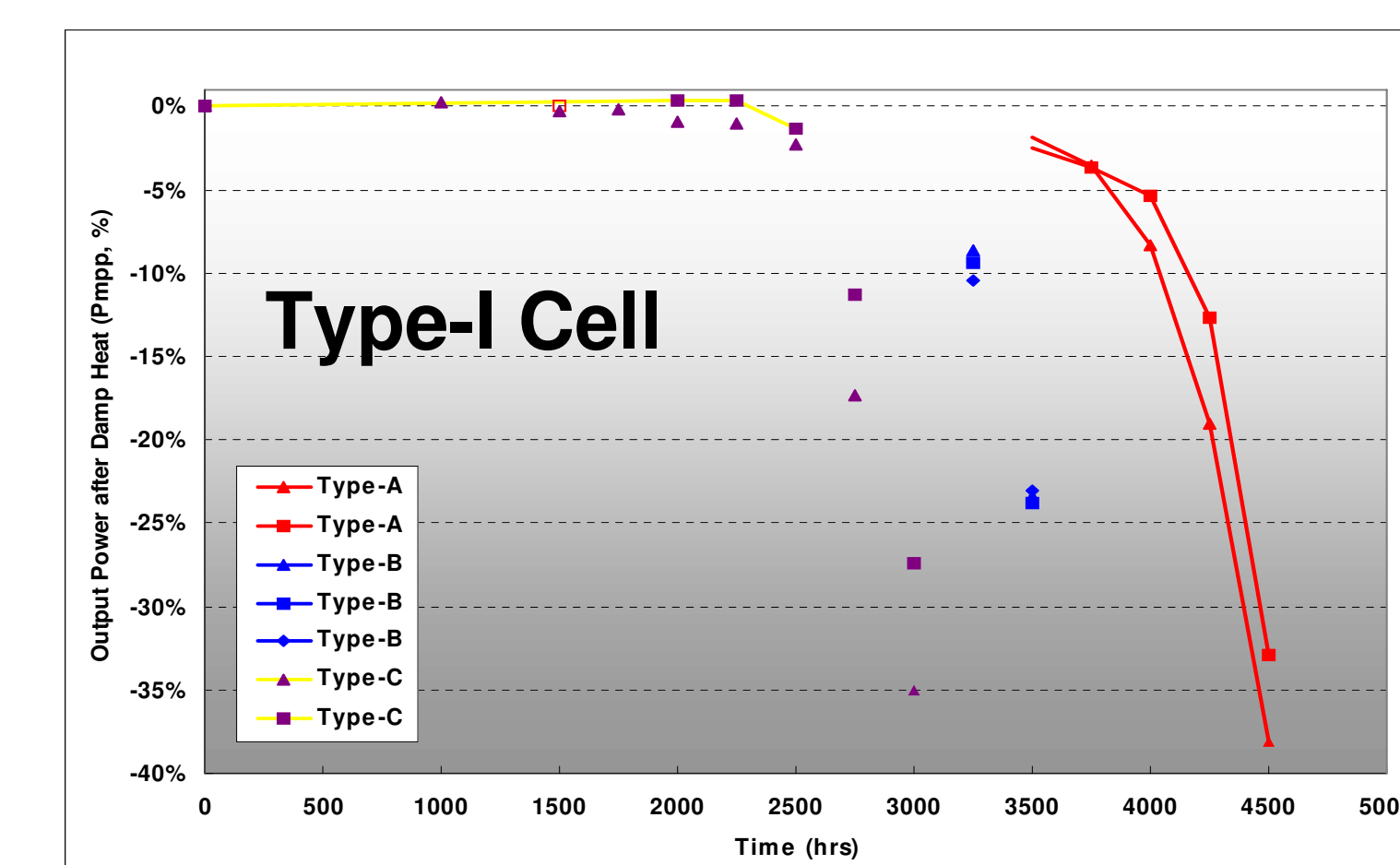
Peeling Test & FT-IR Analysis



Yellowing Effect & Water Vapor Transmission Rate



Reliability Evaluation by Extended Damp Heat Test



The endurance performance for those backsheets is type-A > type-B > type-C. The result from damp heat follows the tendency as water cooking.

Conclusion

- Water cooking test is applied as a fast screening tool to investigate various types of backsheets. Physical and chemical properties such as visual appearance, layer to layer adhesion, PET hydrolysis, yellowing effect and WVTR are distinguished among those backsheets. Comparing the timing for first cracking formation, the accelerated factor for water cooking is around 6 to 8 times higher than damp heat.
- The tendency from water cooking corresponds to the result of long-term damp heat with 2 different types of P-mono cells. We confirm water cooking is efficient and reliable method to evaluate backsheet endurance and predict the influence of backsheet on PV module reliability.