Advanced Characterization of Encapsulation Materials for improved PV Module Performance

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SolPol-3: Solarelectrical Systems based on Polymeric Materials
Novel Polymeric Encapsulation Materials for PV Modules

Project Leader: **JKU Linz** - Institute of Polymeric Materials and Testing (JKU-IPMT)

3 Scientific Partners
- **AIT** – Austrian Institute of Technology, Energy Department – Electric Energy Systems (Vienna)
- JKU Linz - Institute of Analytical Chemistry (**JKU-IAC**)
- JKU Linz - Institute of Polymeric and Testing (**JKU-IPMT**)

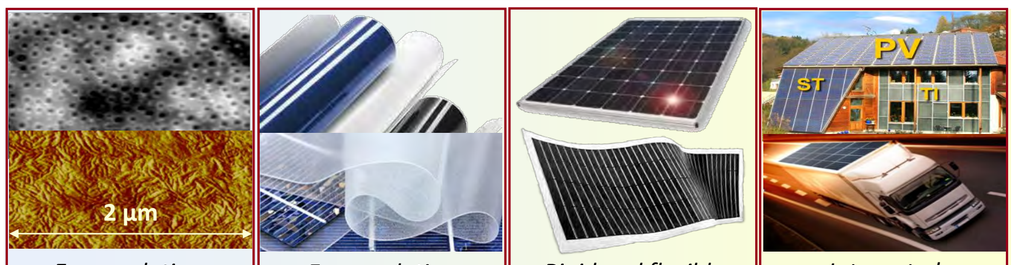
7 Company Partners
- **APC** Advanced Polymer Compunds (Gai, ST)
- **Borealis** AG (Linz, OÖ)
- **KIOTO** Photovoltaics GmbH (St. Veit/Glan, K)
- **Lenzing** Plastics GmbH (Lenzing, OÖ)
- **Perkin Elmer** Vertriebs GmbH (Vienna)
- **SENOPLAST KLEPSCH** & Co. GmbH (Piesendorf, S)
- **Sunplugged** GmbH (Schwaz, T)

Project duration : 07/2011 – 06/2014
Total project costs: 2.3 Mio. EURO

solpol

Five Work Packages – positioned along the value creation chain

WP-01: *Performance Requirements and Test Methods*



Encapsulation Materials | *Encapsulation Films* | *Rigid and flexible PV Modules* | *Integrated PV System*

WP-02: *Embedding Films*
WP-03: *Backsheets and Frontsheets*
WP-04: *Rigid Modules*
WP-05: *Flexible Modules*

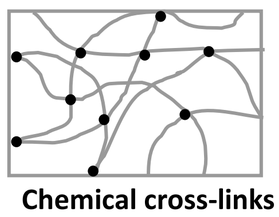
powered by klima+ energie fonds

SolPol-3: Research Program - *Objectives*

From novel Materials ...

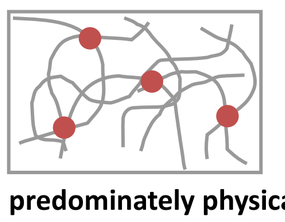
State of Technology

EVA Elastomers



Chemical cross-links (peroxides-based)

Thermoplastic Elastomers



predominately physical cross-links

Development Targets

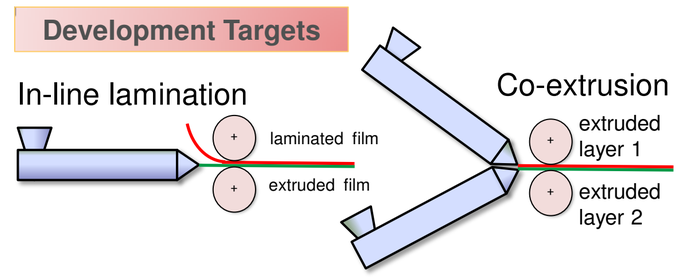
- **shorter lamination cycle times**
- **continuous production (roll-to-roll)**
- **improved performance**

... to new Processes

State of Technology

Backsheet lamination using pre-extruded films

Development Targets

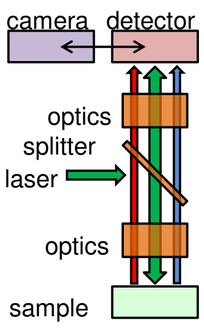


Continuous processing of backsheet/embedding and frontsheet/embedding combinations

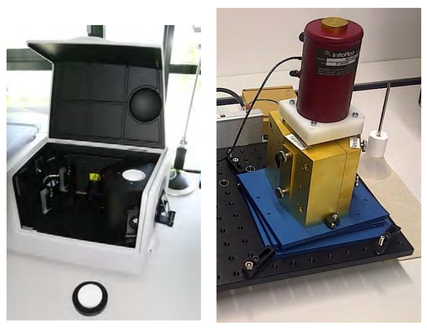
WP-01: Implemented Characterization Methods and selected Results - *Testing on Material, Film, Laminate and Module Level*

Chromatography *(HPLC-UV, -MS)*

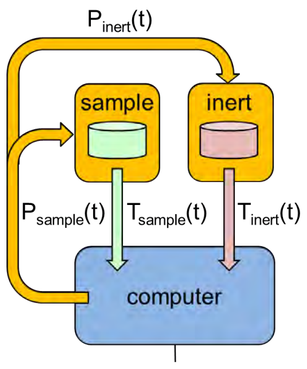
Microscopy *(Optical, Confocal, IR and Raman)*



Spectroscopy *(UVVISNIR, IR, Fluor-escence, Raman)*

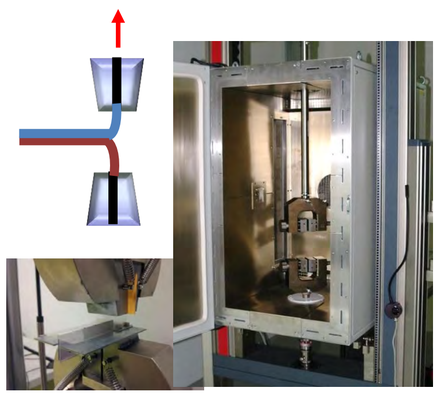


Thermoanalysis *(DTA, DSC, STA)*



Thermomechanics *(DMA, Rheometry)*

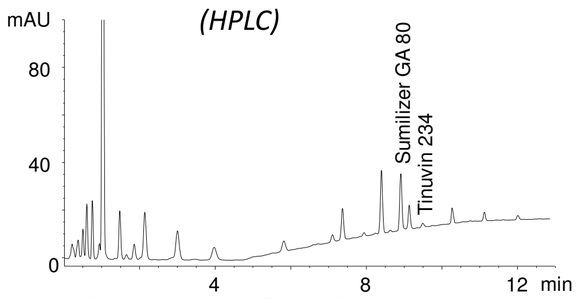
Mechanical Testing *(monotonic, cyclic)*



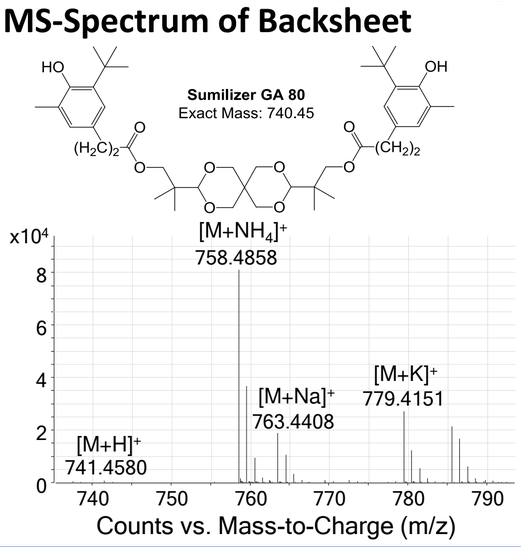
Aging Testing *(dry and damp heat)*

Gaining new Insights via Advanced Methods and Method Combinations

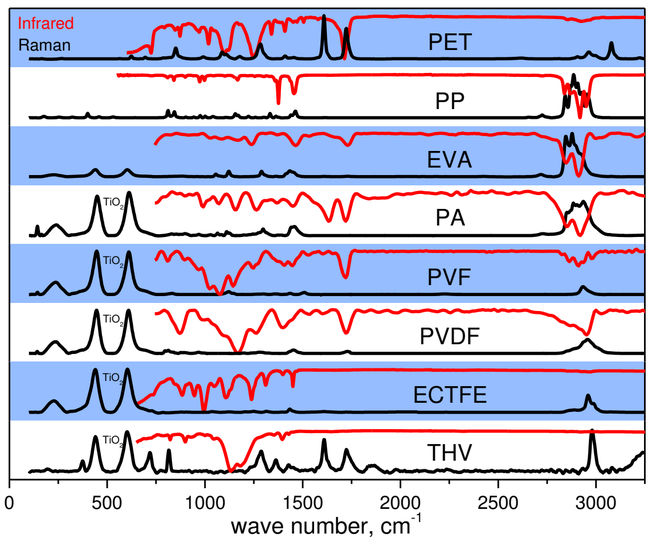
UV-Chromatogram of Backsheet *(HPLC)*



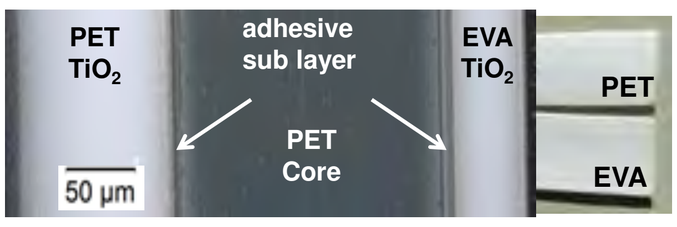
MS-Spectrum of Backsheet



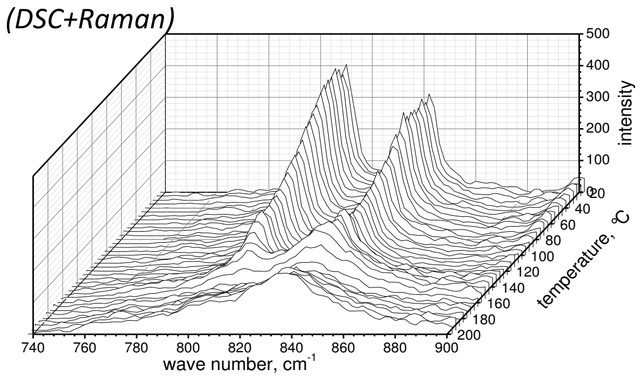
IR-/Raman-Spectra of Backsheets



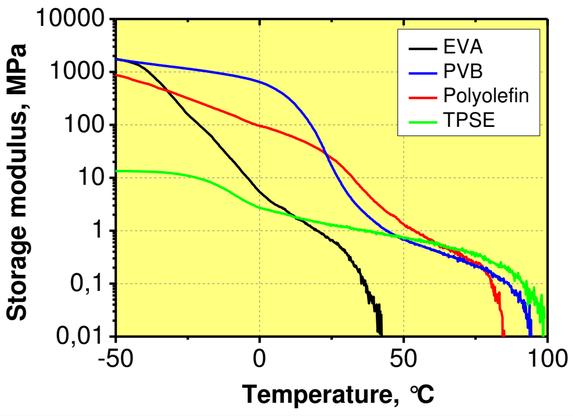
Multilayer PET Backsheet *(OM, IR, Raman)*



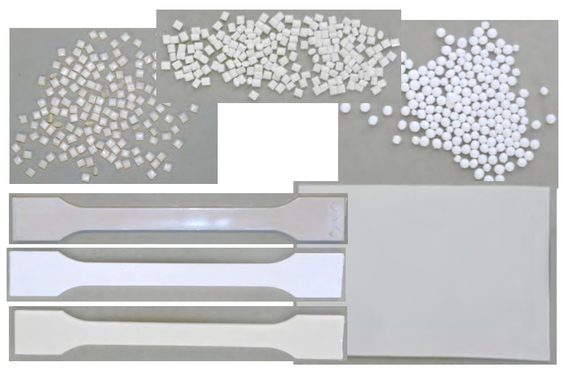
Morphological Transition in Polyolefin *(DSC+Raman)*



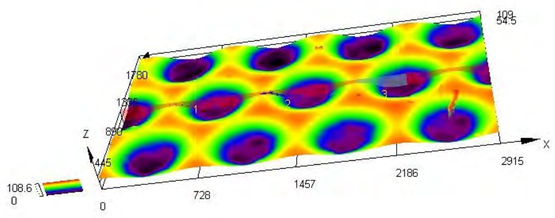
Thermomechanics of Embedding Materials



Novel Backsheet Materials – Granules and Specimen



Topography of Embedding Film after Delamination from Glass *(CM)*



Pyramid structure (Height: 70µm)

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