



COST

COST Action MP1307

Stable Next Generation Photovoltaics: Unraveling Degradation Mechanisms of Organic Solar Cells by Complementary Characterization Techniques.

Experiment 4

Stability of PCDTBT based Organic Solar Cells




Objectives

- Introduce research groups producing encapsulated devices
- Identify the most critical parameters for each type of devices
- Via comparison, simple hints can be exchanged enabling Cell Producers to improve their general device stability
- Help each other to produce State of the art devices
- Create a number of follow up experiments



Experiment Flow

- 
- Solar Cells Fabrication
 - Solar Cell Characterization (non-destructive)
 - Solar Cells ageing
 - Solar Cell Characterization (non-destructive)
 - Solar Cell Characterization (destructive)

Fabrication

Fabrication

Fabrication

Fabrication

Fabrication: @ ...

Non-destructive Characterization

Degradation protocol 1

Degradation protocol 2

Degradation protocol 3

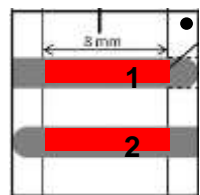
Degradation protocol 4

Degradation protocol 5

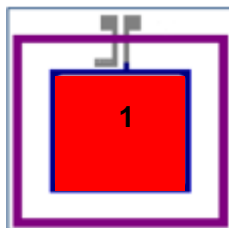
Non-destructive Characterization

Solar Cells Fabrication

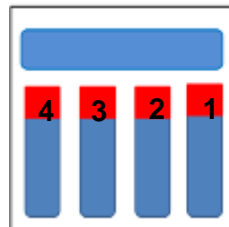
Research institute	Responsible person	Country
Instituto de Telecomunicações	Ana Charas	PT
Solliance	Yulia Galagan	NL
Vrije Universiteit (VUA)	Elizabeth von Hauff	NL
Uniroma2 (UTV)	Francesca Brunetti	IT
Karlstad University	Ellen Moons	SE
TEI of Crete	Emmanuel Kymakis	GR
Universitat Rovira i Virgili	Josep Ferré-Borrull	ES



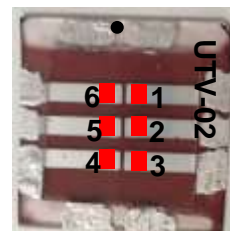
Lisbon



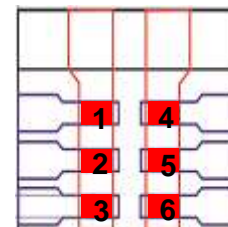
Solliance



VU-Amst



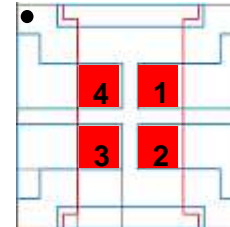
UTV Rome



Karlstad



TEIC



URV

Solar Cell Characterization (non-destructive)

Characterization technique	Research institute	Country
PAIOS	Fluxim	SZ
Photoluminescence	Univ. Jena	DE

PAIOS - performs a variety of different experimental techniques (Photo-CELIV, Impedance Spectroscopy, Capacitance-voltage, Transient photovoltage (TPV), Transient photocurrent (TPC), IV & IVL...)

Solar Cells Ageing

- Reference Dark Storage Shelf Life – *ISOS-D-1*
- High Temp. Dark Storage – *ISOS-D-2*
- Indoor room Temp. Light Soaking – *ISOS-L-1*
- Indoor High Temp. Light Soaking – *ISOS-L-2*
- Real-Time Outdoor Ageing – *ISOS-O-1*

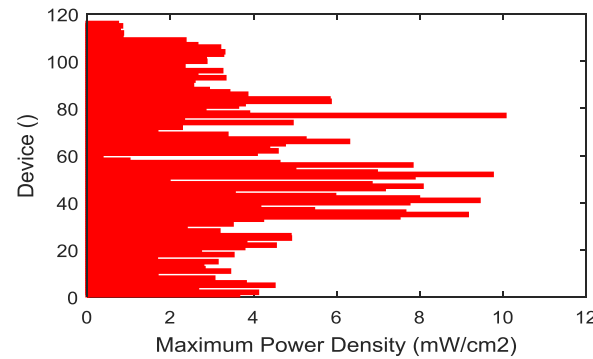
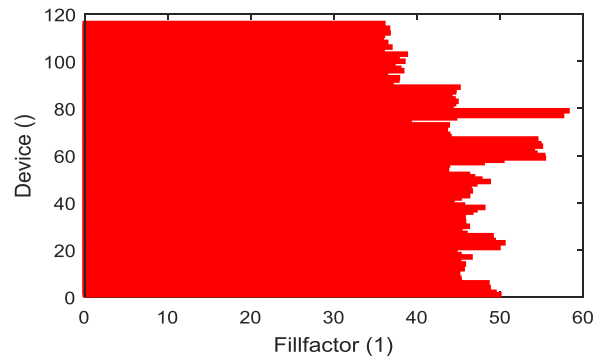
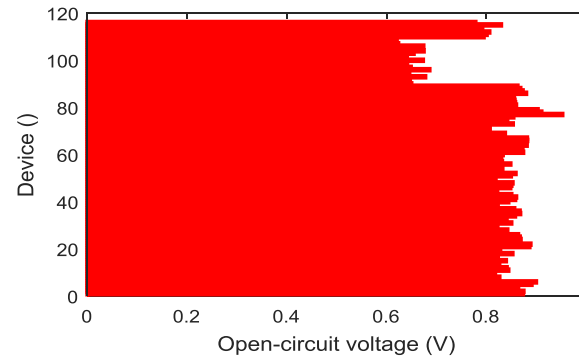
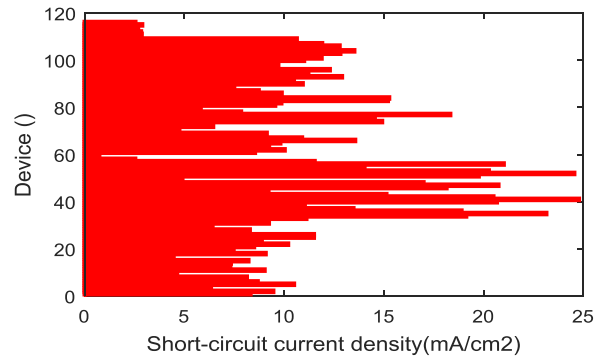
Ageing condition	Research institute	Country
ISOS-D1	VU Amsterdam	NL
ISOS-D2	ECN	NL
ISOS-L1	Univ. Jena	DE
ISOS-L2	Univ. Jena	DE
ISOS-O1	Ben-Gurion Univ.	IL

Experiment Flow

Each cell producer provides 10 samples which are characterized according the following map:

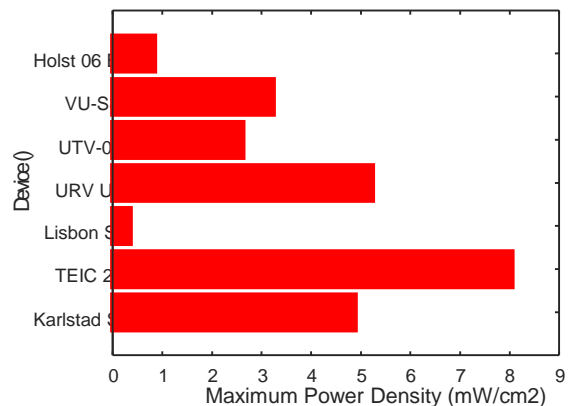
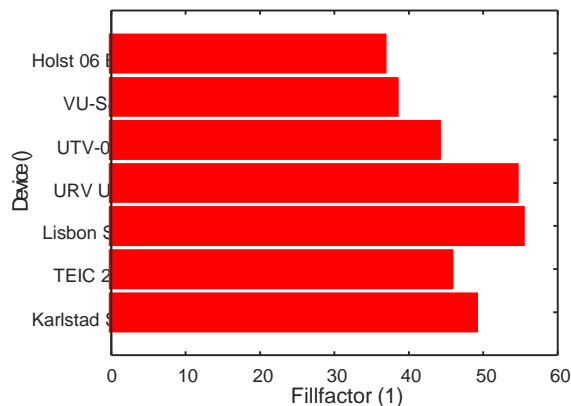
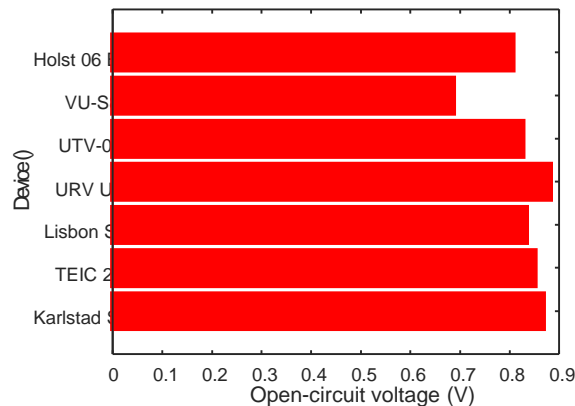
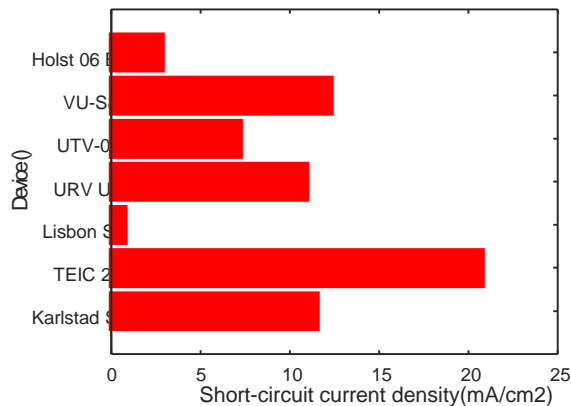
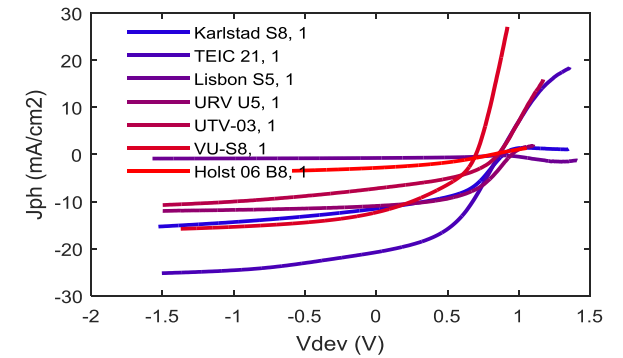
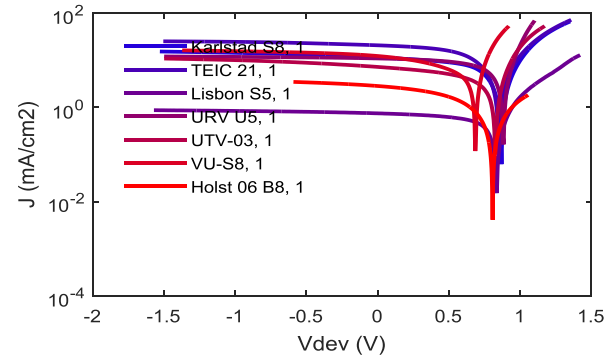
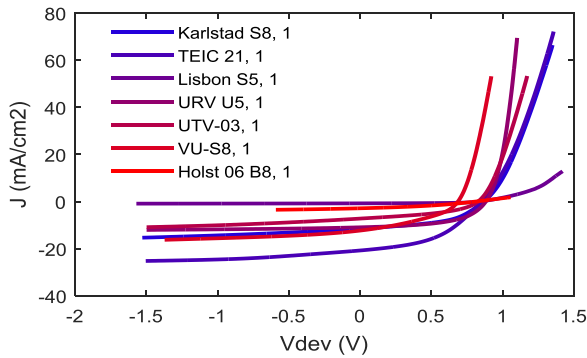
Samples No	PL	Paios	ISOS-D1	ISOS-D2	ISOS-L1	ISOS-L1	ISOS-O1	PL	Paios
1	x		x					x	
2		x	x						x
3	x			x				x	
4		x		x					x
5	x				x			x	
6		x			x				x
7	x					x		x	
8		x				x			x
9	x						x	x	
10		x					x		x

Initial Results – all devices



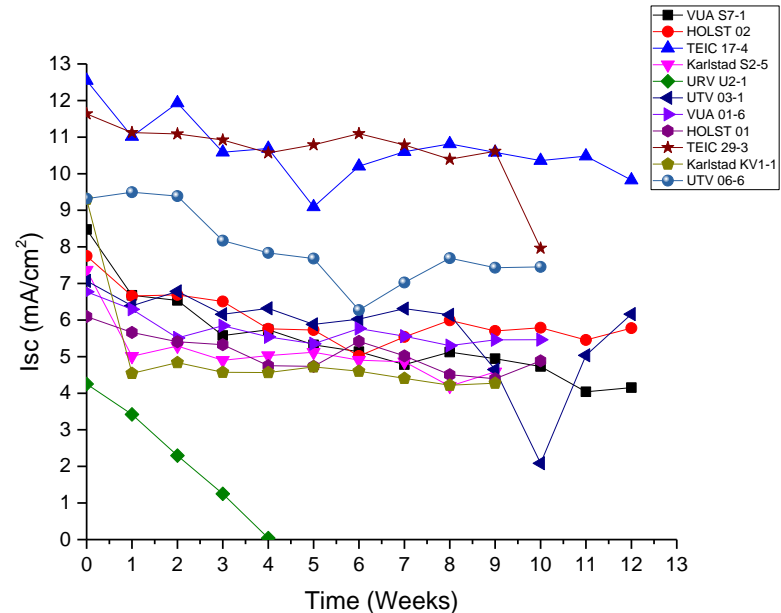
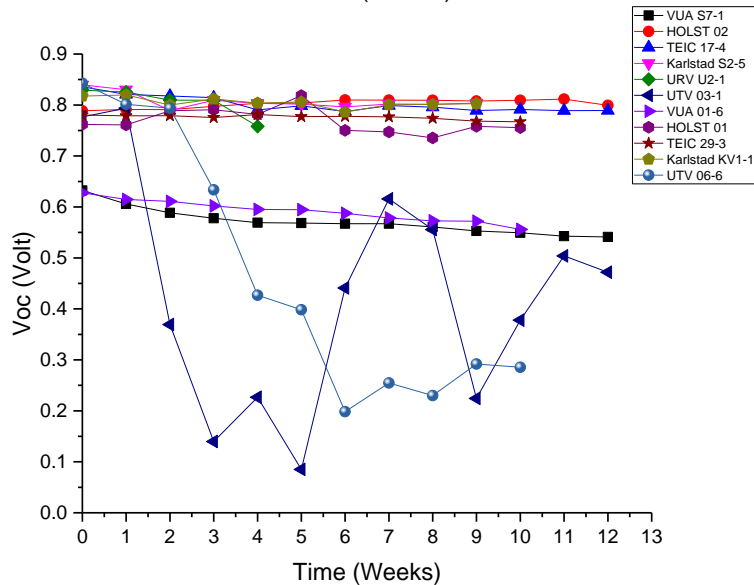
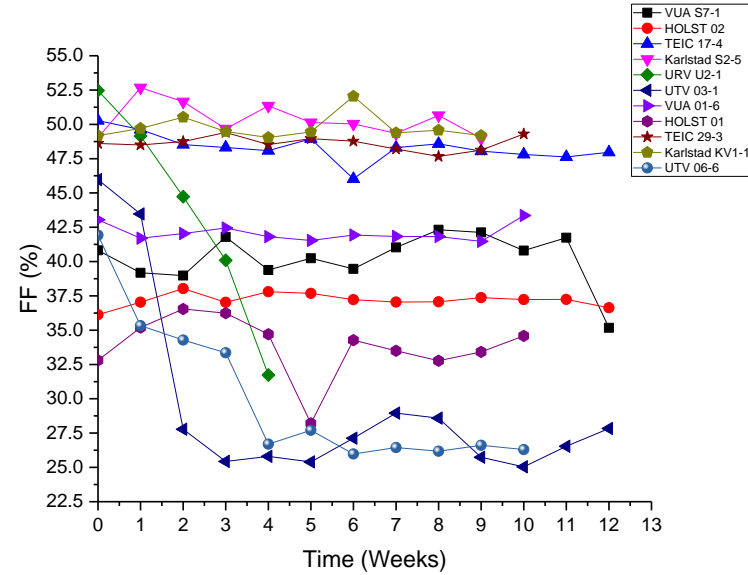
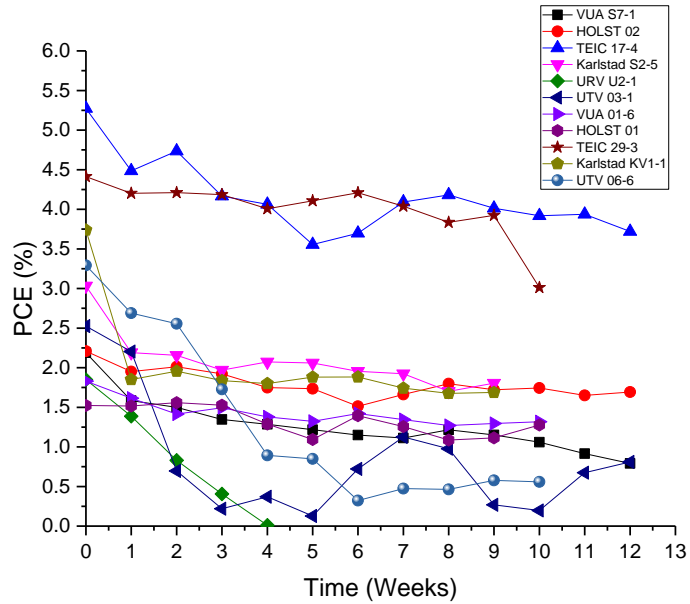
- IV-curves were measured for all devices.
- Plots show parameters for all working devices.

Initial Results – selected devices



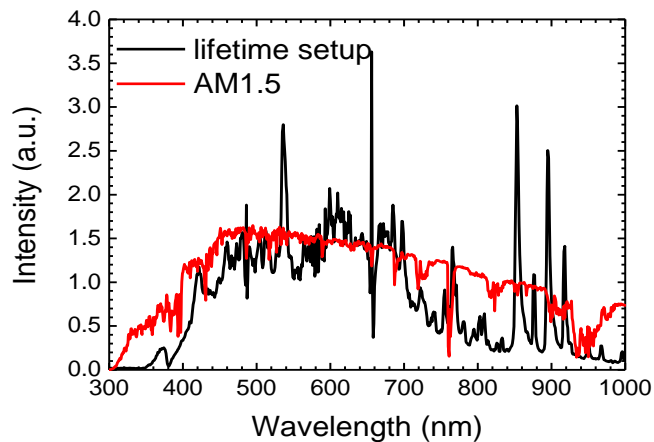
- IV-curves and parameters for selected devices, one device per group.
- Jph (upper graph) shows light minus dark IV

ISOS - D1 Degradation - Results



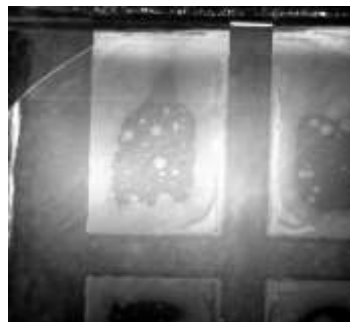
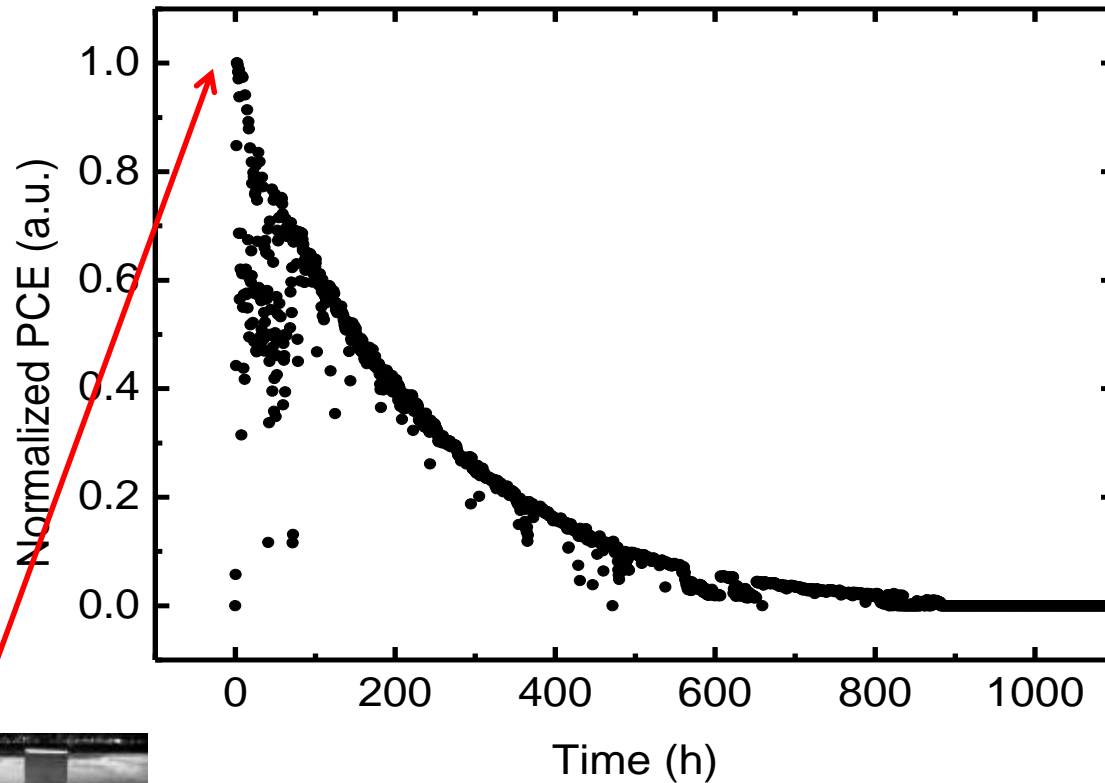
ISOS - L1 Degradation

- **Degradation parameters:**
 - constant illumination at 1 sun
 - ambient temperature and humidity
 - periodic IV-characterization (every 30 min) over ~1000 h



ISOS - L1 Degradation - Results

- Example: Sample of the Universitat Rovira i Virgili

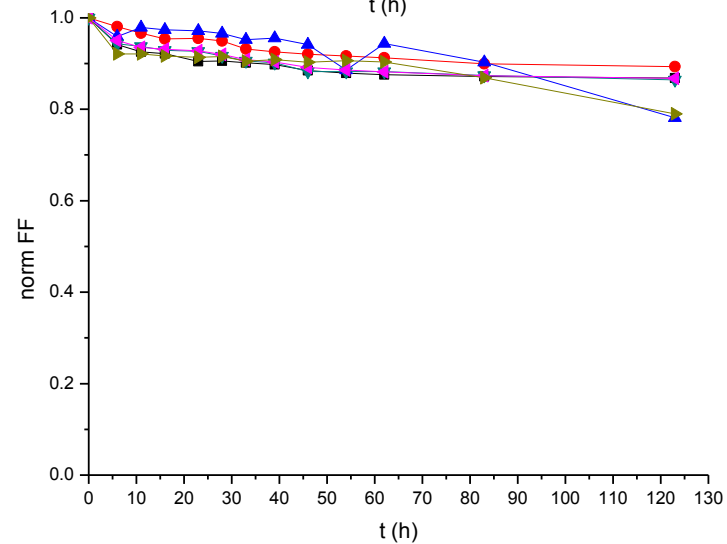
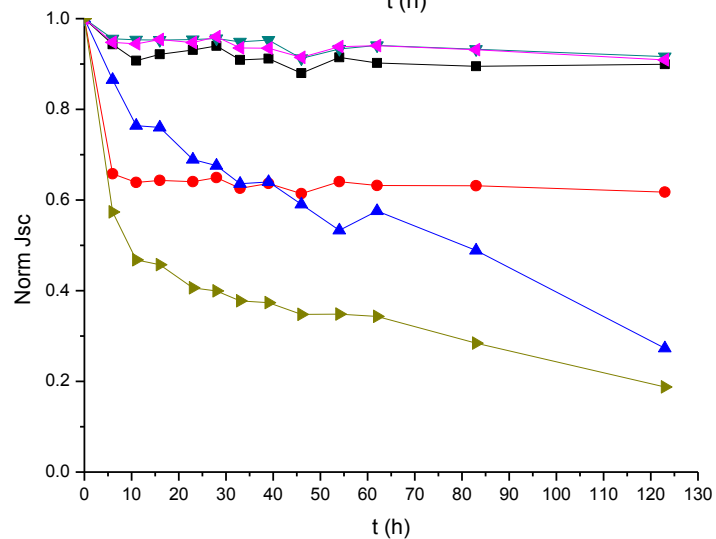
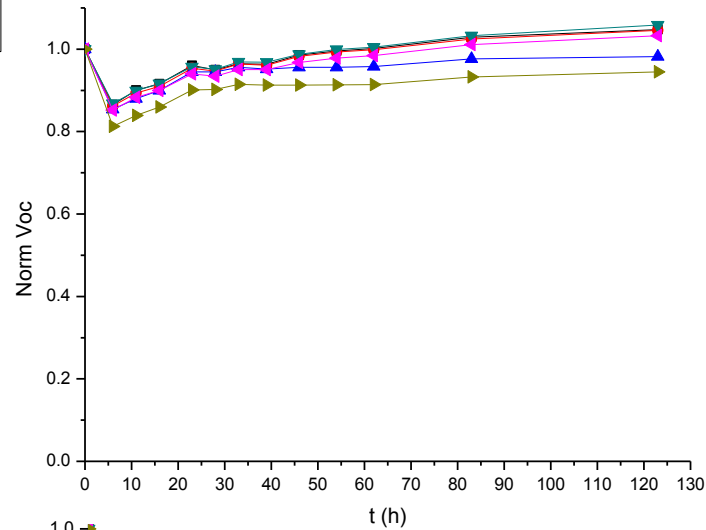
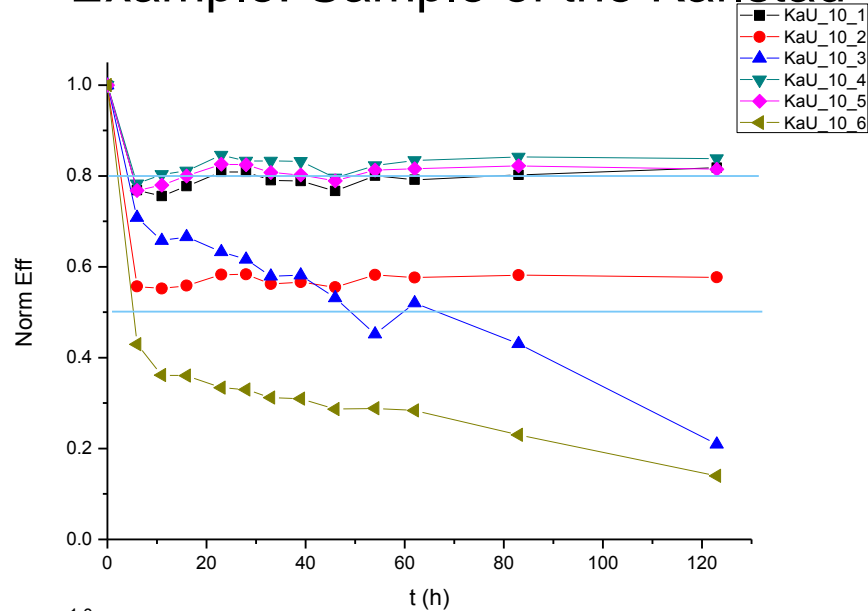


**Photoluminescence images:
Before and after
degradation**



ISOS - O1 Degradation - Results

- Example: Sample of the Karlstad University





Outlook

- The Experiment is ongoing
- After ageing and non destructive characterization the samples might be characterized with destructive techniques
- The results will be shared with all consortium
- The results will be summarized in a joint paper