
StableNextSol – MP1307

- STABILITY AND DEGRADATION STUDIES OF ORGANIC AND HYBRID PV DEVICES BY MEANS OF CONCENTRATED SUNLIGHT-
  STSM Ref No:

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3rd MC Meeting, 2nd WG Meeting, 2nd Conference E-MRS Symposium E @ E-MRS. Lile, Fr. May 11th-12th, 2015
HOST LAB: Center for Hybrid and Organic Solar Energy (CHOSE), University of Rome Tor Vergata (UTV), Italy
GUEST LAB: Dept. of Solar Energy and Environmental Physics, Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev (BGU), Israel
ESR NAME: Laura Ciammaruchi  -  Duration: 30 days

Objectives:
(1) Fabricate OPV cells with PTB7:PCBM active layer, blended in chlorinated and non-chlorinated solvents (@UTV), to study shelf-life and accelerated degradation with concentrated sunlight (@BGU).
(2) Learning basic perovskite syntesis processes (@UTV), in order to establish a fabrication station, and study the stability as a function of the halogen content in the perovskite material (@BGU).
8.7% Power conversion efficiency polymer solar cell realized with non-chlorinated solvents

• Project 1 - Experiments performed

- Fabricated two batches of [ITO/PEIE/PTB7:[70]PCBM/MoO3/Ag] cells, using Chlorobenzene and o-Xylene as solvents.

- Monitored shelf-life of non-encapsulated devices in glove-box/air. Measurements performed for 1080 hours.
J-V curve evolution over time for devices realized with different solvents.

Chlorobenzene

O-Xylene

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- Control (glove-box storage)
- Chlorobenzene (non-encaps)
- o-Xylene (non-encaps)

Graphs showing changes in:
- $V_{oc}$ normalized efficiency
- $J_{sc}$ normalized current
- $FF$ normalized fill factor
- Efficiency $Eff$ over shelf life (hrs) for different conditions.
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- **Eff** (Efficiency)
  - control (glove-box storage)
  - Chlorobenzene (non-encaps)
  - o-Xylene (non-encaps)

- **Jsc** (Short Circuit Current Density)
  - control (glove-box storage)
  - Chlorobenzene (non-encaps)
  - o-Xylene (non-encaps)

- **FF** (Fill Factor)
  - control (glove-box storage)
  - Chlorobenzene (non-encaps)
  - o-Xylene (non-encaps)

- **Voc** (Open Circuit Voltage)
  - control (glove-box storage)
  - Chlorobenzene (non-encaps)
  - o-Xylene (non-encaps)
RESULTS - (1)

**CHLOROBENZENE**

**O-XYLENE**
AFM phase

CB-blended PAL_fresh

After 400h shelf life

O-Xy blended PAL_fresh

After 400h shelf life

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Difference spectra

- PTB7:PCBM in Chlorobenzene 400h shelf life
- PTB7:PCBM in o-Xylene 400h shelf life

Normalized loss of absorbed photons vs. wavelength (nm)
• CONCLUSIONS

- Successful and effective collaboration established between the two partner institutions. Complementary fabrication/characterization tools shared and employed

- O-xylene – blended films/cells show comparable/better shelf-life stability compared to chlorobenzene-blended films/cells.

>>Poster presented at HOPV 2015 Conference
• FUTURE WORK
  - @ BGU: accelerated stress tests under varying T and photon dose of encapsulated devices/ films.
  - @UTV: parallel outdoor degradation studies, to test devices at different latitudes and radiation intensities.