Perovskite PV and Organic PV Voc–loss Analyzer: REPS

Boost Your PV Efficiency and Publication.

Introduction

To push the conversion efficiency to the limitation of Thermodynamics, organic solar cells and perovskite solar cells strive to increase the open–circuit voltage (Voc) to Shockley–Queisser limit. REPS is a complete system that can help scientists measure, calculate, and analyze the Voc–loss in the working solar cells, and give the process improving idea for the next step.

REPS not only can detect the extremely low EL–EQE signal (as low as 10–5%, which is 7 orders of magnitude), but can also calculate thermodynamic Voc, radiative recombination Voc, and non–radiative recombination Voc (through its software SQ–VLA). In addition, it can also analyze ΔE1, ΔE2, and ΔE3 losses between different type of devices in one histogram chart. Most importantly, the analyzing software can help users match the calculated Voc–loss with the real Voc–loss of the device IV curve, thereby promoting the research progress and journal publication.

Features

- It can measure absolute EL–EQE, EL spectra(V), JV curve, EQE–J.
- The software can display the charts including EL–EQE(J), EL–EQE(V), multi–EL–spectra, JVL curve, ΔE1, ΔE2, and ΔE3 histogram chart.
- The system can calculate and analyze thermodynamic Voc, radiative recombination Voc, and non–radiative recombination Voc.
- The wavelength detection range: 300~1100nm; and can be extended to 1700nm (option).
- NIST–traceable absolute radiometric calibration (Watt, from 300~1100nm).
- EL–EQE detection range: 10–5% to 100% (Dynamic range 7 orders).
- EL–EQE un–repeatability < 1%.
- EL low–light detection SN ratio: >50:1 @5×10–5% (REPS Pro).
- Glove Box integration toolkit.
- Customized test fixtures.

Application

- OPV Voc–loss study
- Perovskite solar cells Voc–loss study
- Charge transfer state identification through ultra–sensitive EL–EQE spectrum

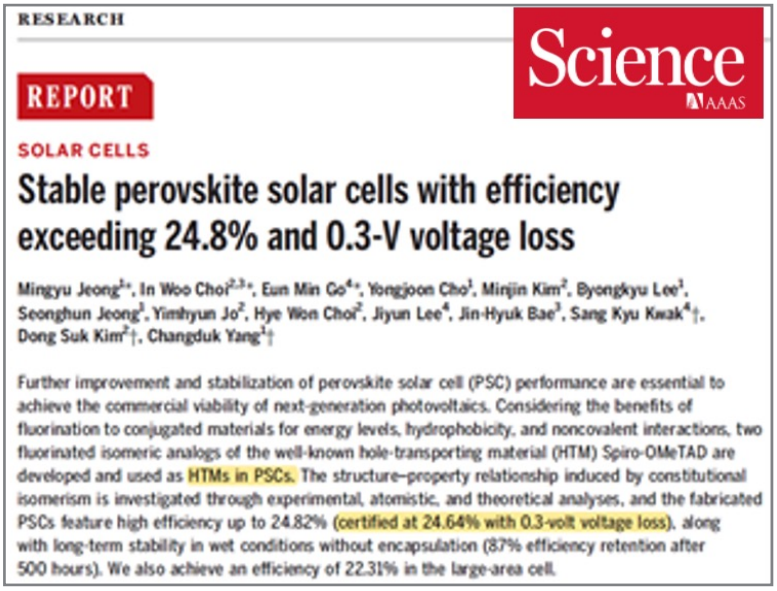
Specification / Product Selection Guide

We provide three different types of REPS system to match your requirement which have with different detection capability and speed.

	Lowest EL–EQE detection	Measuring speed	Un–repeatability	Suggested application
REPS–Pro	100%～1x10^{-5}% (≧ 7 orders)	Fast (12,500 sa/sec)*	(12,500 sa/sec)* ≦ 1% SN ratio: >50:1@5x10^{-5}%	Both OPV and PSC
REPS–G2	100%～5x10^{-5}% (≧ 6.5 order)	Medium (1,000 sa/sec)*	≦ 1% SN ratio: >50:1@5x10^{-5}%	Both OPV and PSC
REPS +	100%～1x10^{-4}% (≧ 6 orders)	Slow (1～3 sec for 1 sa)*	≦ 2%	Only PSC

*sa/sec: samples per second; PSC: Perovskite Solar Cells

Testing Results / Publications



RESEARCH

REPORT

Science AAAS

SOLAR CELLS

Stable perovskite solar cells with efficiency exceeding 24.8% and 0.3-V voltage loss

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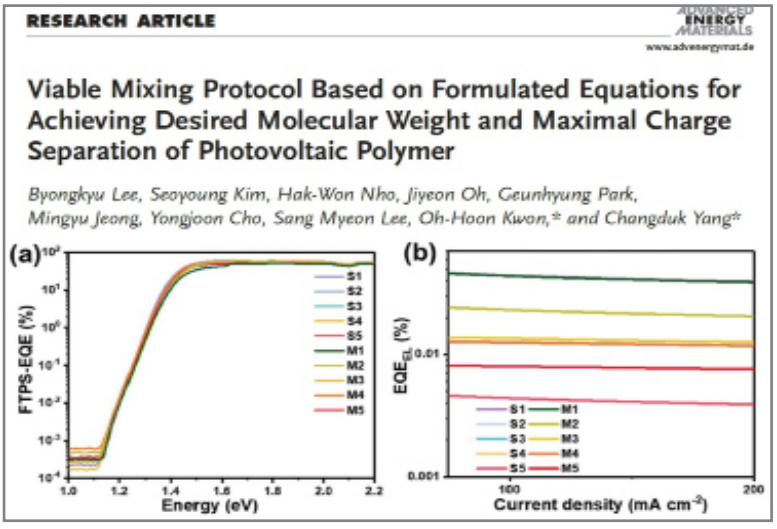
Further improvement and stabilization of perovskite solar cell (PSC) performance are essential to achieve the commercial viability of next-generation photovoltaics. Considering the benefits of fluorination to conjugated materials for energy levels, hydrophobicity, and noncovalent interactions, two fluorinated isomeric analogs of the well-known hole-transporting material (HTM) Spiro-OMeTAD are developed and used as HTMs in PSCs. The structure–property relationship induced by constitutional isomerism is investigated through experimental, atomistic, and theoretical analyses, and the fabricated PSCs feature high efficiency up to 24.82% (certified at 24.64% with 0.3-volt voltage loss), along with long-term stability in wet conditions without encapsulation (87% efficiency retention after 500 hours). We also achieve an efficiency of 22.31% in the large-area cell.

24.8% Perovskite Solar Cells in Science

In 2020, UNIST in South Korea used REPS and FTPS systems to study Spiro–OMeTAD as a hole transport material for perovskite solar cells and the mechanism of Voc loss. They reported a certified 24.8% high–efficiency perovskite solar cell and published in 2020 Year's Science Journal (IF=47.728).



RESEARCH ARTICLE

ADVANCED ENERGY MATERIALS

www.advenergymat.de

Viable Mixing Protocol Based on Formulated Equations for Achieving Desired Molecular Weight and Maximal Charge Separation of Photovoltaic Polymer

Byongkyu Lee, Seoyoung Kim, Hak-Won Nho, Jiyeon Oh, Geunhyung Park, Mingyu Jeong, Yongjoon Cho, Sang Myeon Lee, Oh-Hoon Kwon, and Changduk Yang**

PM6 molecular weight and PCE

In 2021, scientists used the REPS and FTPS systems to study the relationship between the conversion efficiency and molecular weight of organic solar cells, and to explore the related loss mechanism. The properties of synthesized and blended PM6 polymer series of different molecular weights were systematically investigated to determine the effect of molecular weight on the relevant PSC properties. Results published in Advance Energy Materials 2021 (IF=29.368).

More Information ▶