

IN THIS ISSUE

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Cover
See Krebs *et al.*,
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Inside cover
See Xiang, Chen *et al.*,
pp. 2868–2899.
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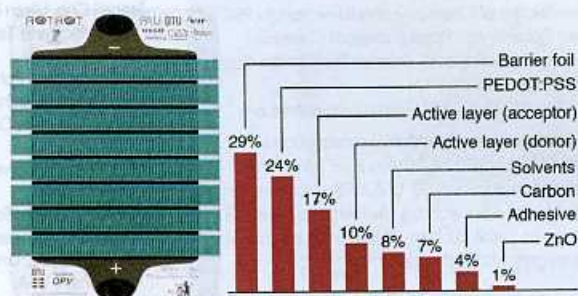
ANALYSIS

2792

Cost analysis of roll-to-roll fabricated ITO free single and tandem organic solar modules based on data from manufacture

F. Machuj,* M. Hösel, N. Li, G. D. Spyropoulos, T. Ameri, R. R. Søndergaard, M. Jørgensen, A. Scheel, D. Gaiser, K. Kreul, D. Lenssen, M. Legros, N. Lemaitre, M. Vilkmann, M. Välimäki, S. Nordman, C. J. Brabec and F. C. Krebs

Based on state of the art coating processes a cost analysis of organic solar modules for different scenarios was evaluated.



REVIEWS

2803

Cellulose and hemicellulose valorisation: an integrated challenge of catalysis and reaction engineering

I. Delidovich, K. Leonhard and R. Palkovits*

Concepts for the integration of catalytic transformations, reaction engineering and product separation are discussed as pre-requisites for efficient production of fuels and chemicals based on lignocellulose.

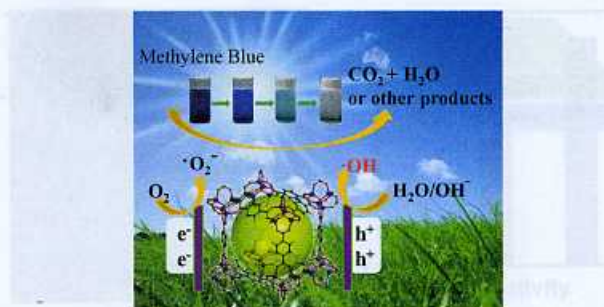


2831

Photocatalytic organic pollutants degradation in metal–organic frameworks

Chong-Chen Wang, Jian-Rong Li,* Xiu-Liang Lv, Yan-Qiu Zhang and Guangsheng Guo*

This review summarizes research advances in photocatalytic organic pollutant degradation in metal–organic frameworks.



PERSPECTIVES

2868

Perspective of microporous metal–organic frameworks for CO₂ capture and separation

Zhangjing Zhang, Zi-Zhu Yao, Shengchang Xiang* and Banglin Chen*

Metal–organic frameworks as emerging porous materials have been summarized and prospected for their potential for carbon dioxide storage and separation (CCS) and compared with traditional zeolites.

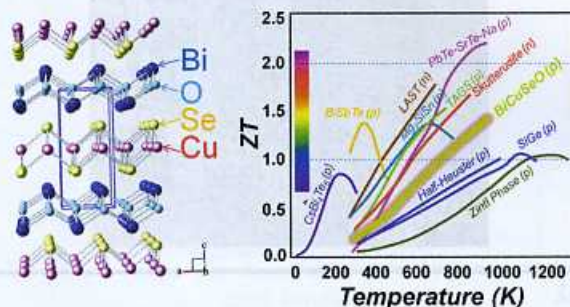


2900

BiCuSeO oxyselenides: new promising thermoelectric materials

Li-Dong Zhao,* Jiaqing He, David Berardan, Yuanhua Lin, Jing-Feng Li, Ce-Wen Nan and Nita Dragoe*

This review summarizes the crystal structures, microstructures, electronic structures, physical/chemical properties, and effective methods to enhance the thermoelectric performance of the BiCuSeO system.



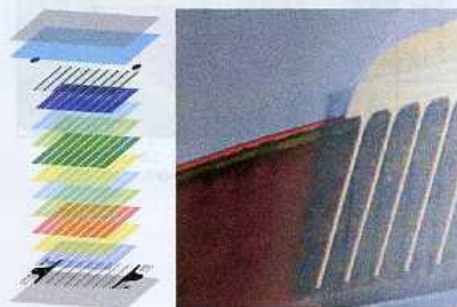
COMMUNICATIONS

2925

Scalable, ambient atmosphere roll-to-roll manufacture of encapsulated large area, flexible organic tandem solar cell modules

T. R. Andersen, H. F. Dam, M. Hösel, M. Helgesen, J. E. Carlé, T. T. Larsen-Olsen, S. A. Gevorgyan, J. W. Andreasen, J. Adams, N. Li, F. Machui, G. D. Spyropoulos, T. Ameri, N. Lemaître, M. Legros, A. Scheel, D. Gaiser, K. Kreul, S. Berny, O. R. Lozman, S. Nordman, M. Välimäki, M. Vilkmann, R. R. Søndergaard, M. Jørgensen, C. J. Brabec and F. C. Krebs*

Fully ambient manufacture of flexible tandem OPV modules.



2934

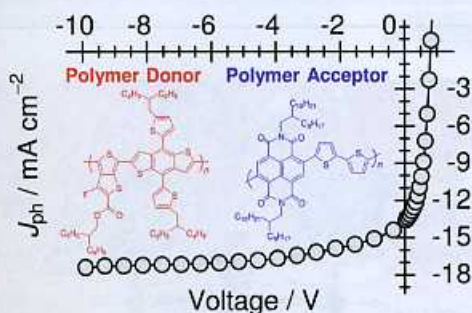


Retarding the crystallization of PbI_2 for highly reproducible planar-structured perovskite solar cells via sequential deposition

Yongzhen Wu, Ashrafal Islam, Xudong Yang,*
Chuanjiang Qin, Jian Liu, Kun Zhang, Wenqin Peng
and Liyuan Han*

A universally useful idea for preparing high quality perovskite films is proposed by retarding the crystallization of PbI_2 , which make possible highly reproducible planar structured perovskite solar cells.

2939

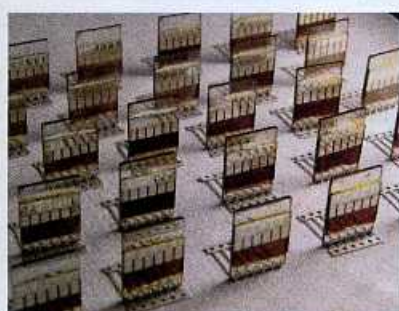


Highly efficient charge-carrier generation and collection in polymer/polymer blend solar cells with a power conversion efficiency of 5.7%

Daisuke Mori, Hiroaki Bente, Izumi Okada, Hideo Ohkita
and Shinzaburo Ito*

A polymer/polymer blend solar cell with an external quantum efficiency approaching 60% and the best power conversion efficiency of 5.73% is fabricated.

2944

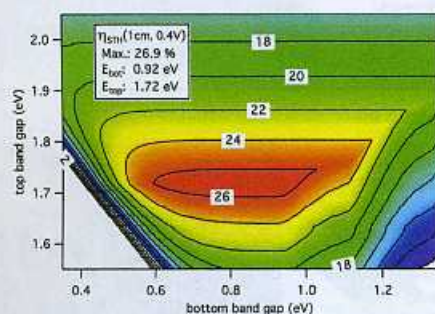


Efficient planar heterojunction mixed-halide perovskite solar cells deposited via spray-deposition

Alexander T. Barrows, Andrew J. Pearson, Chan Kyu Kwak,
Alan D. F. Dunbar, Alastair R. Buckley and David G. Lidzey*

Perovskite solar cells prepared via spray-deposition of the active layer have been realized, advancing this promising technology towards roll-to-roll compatible processing methods.

2951



Sunlight absorption in water – efficiency and design implications for photoelectrochemical devices

H. Döscher,* J. F. Geisz, T. G. Deutsch and J. A. Turner

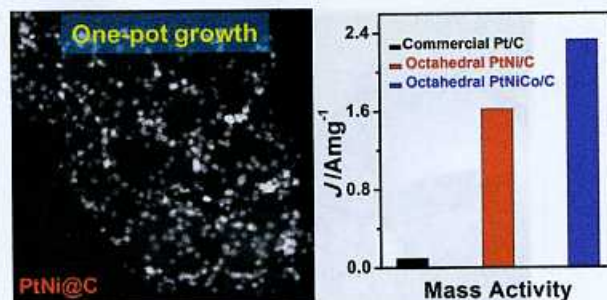
Sunlight absorption within the electrolyte impacts the performance and design of high-efficiency tandem PEC devices as evidenced by detailed balance calculations.

2957

A rational design of carbon-supported dispersive Pt-based octahedra as efficient oxygen reduction reaction catalysts

Xiaoqing Huang, Zipeng Zhao, Yu Chen, Enbo Zhu, Mufan Li, Xiangfeng Duan and Yu Huang*

Highly dispersive carbon-supported octahedral Pt-based catalysts were prepared by an efficient one-pot synthetic strategy without using any bulky capping agents and were demonstrated as promising catalysts for oxygen reduction reaction (ORR).

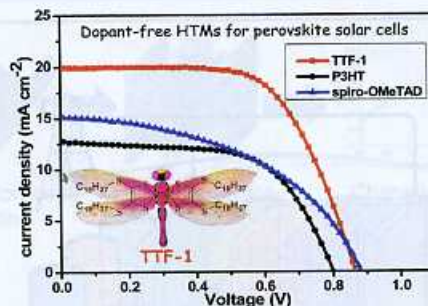


2963

A dopant-free hole-transporting material for efficient and stable perovskite solar cells

Jian Liu, Yongzhen Wu, Chuanjiang Qin, Xudong Yang,* Takeshi Yasuda, Ashraf Islam, Kun Zhang, Wenqin Peng, Wei Chen and Liyuan Han*

A tetrathiafulvalene derivative (TTF-1) was introduced into perovskite solar cells as a dopant-free hole-transporting material, yielding an efficiency over 11%.

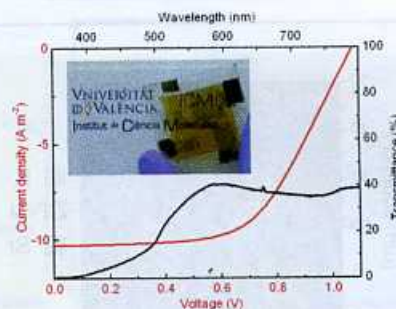


2968

High efficiency single-junction semitransparent perovskite solar cells

Cristina Roldán-Carmona, Olga Malinkiewicz, Rafael Betancur, Giulia Longo, Cristina Momblona, Franklin Jaramillo, Luis Camacho and Henk J. Bolink*

Semitransparent efficient methylammonium lead iodide perovskite based solar cells.

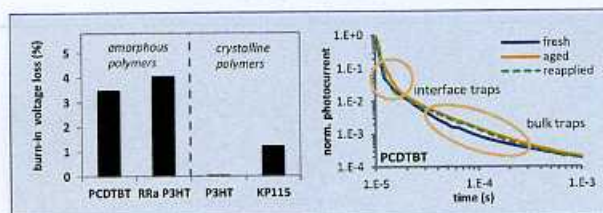


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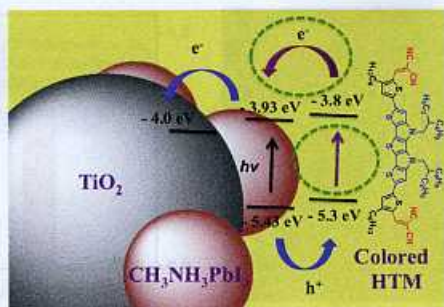
Reducing burn-in voltage loss in polymer solar cells by increasing the polymer crystallinity

Thomas Heumueller, William R. Mateker, I. T. Sachs-Quintana, Koen Vandewal, Jonathan A. Bartelt, Timothy M. Burke, Tayebah Ameri, Christoph J. Brabec and Michael D. McGehee*

Light induced traps in the bulk of organic solar cells are correlated with V_{oc} losses and those losses are reduced by a high degree of polymer crystallinity.



2981



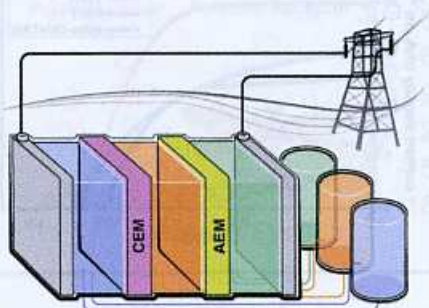
Low band gap *S,N*-heteroacene-based oligothiophenes as hole-transporting and light absorbing materials for efficient perovskite-based solar cells

Peng Qin, Hannelore Kast, Mohammad K. Nazeeruddin, Shaik M. Zakeeruddin, Amaresh Mishra,* Peter Bäuerle and Michael Grätzel*

Heteroacene-based molecular hole transport materials were synthesized and implemented in perovskite-based solar cells generating promising efficiencies up to 10.5%.

PAPERS

2986

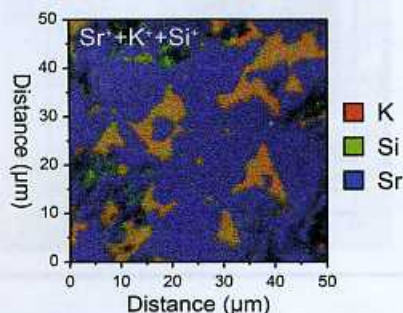


A multiple ion-exchange membrane design for redox flow batteries

Shuang Gu,* Ke Gong, Emily Z. Yan and Yushan Yan*

A redox-flow-battery cell design with multiple ion-exchange membranes is provided to enable combinations of any redox pairs and supporting electrolytes.

2999

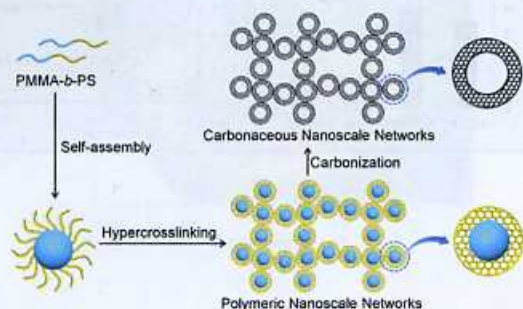


On the oxide ion conductivity of potassium doped strontium silicates

Ryan D. Bayliss,* Stuart N. Cook, Sarah Fearn, John A. Kilner, Colin Greaves and Stephen J. Skinner

In this work, isotope exchange depth profiling eliminates oxygen ions as the majority charge carrier in the newly proposed solid oxide fuel cell electrolyte $\text{Sr}_{0.8}\text{K}_{0.2}\text{Si}_{0.5}\text{Ge}_{0.5}\text{O}_{2.8}$.

3006



Fabrication of novel polymeric and carbonaceous nanoscale networks by the union of self-assembly and hypercrosslinking

Zhenghui Li, Dingcai Wu,* Xin Huang, Junhao Ma, Hao Liu, Yeru Liang, Ruowen Fu and Krzysztof Matyjaszewski*

Novel polymeric and carbonaceous nanoscale networks with a well-defined nanostructure are successfully developed by the union of self-assembly and hypercrosslinking.

3013

Results of a 20 000 h lifetime test of a 7 kW direct methanol fuel cell (DMFC) hybrid system – degradation of the DMFC stack and the energy storage

N. Kimiaie,* K. Wedlich, M. Hehemann, R. Lambertz, M. Müller, C. Korte and D. Stolten

First-ever lifetime test of a DMFC system lasting 25 600 h with a dynamic load profile of a material handling vehicle.

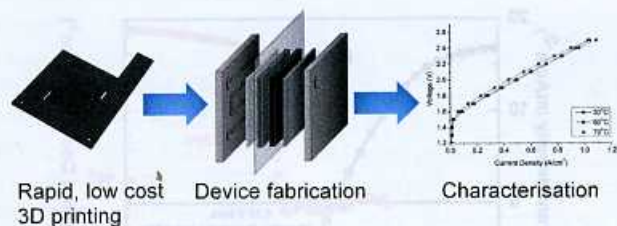


3026

3D printed flow plates for the electrolysis of water: an economic and adaptable approach to device manufacture

Greig Chisholm, Philip J. Kitson, Niall D. Kirkaldy, Leanne G. Bloor and Leroy Cronin*

3D printed polypropylene flow plates, suitably coated to increase conductivity, are used in electrolyzers for the production of hydrogen representing a cheaper and faster method for prototyping device configuration.

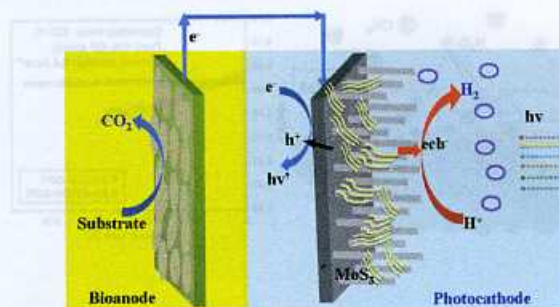


3033

A bio-photoelectrochemical cell with a MoS₃-modified silicon nanowire photocathode for hydrogen and electricity production

Guo-Long Zang, Guo-Ping Sheng,* Chen Shi, Yun-Kun Wang, Wen-Wei Li and Han-Qing Yu*

A bio-photoelectrochemical cell with a bioanode and a MoS₃/SiNW photocathode is successfully constructed for hydrogen production under visible light illumination.

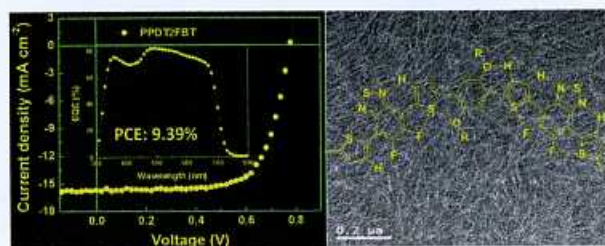


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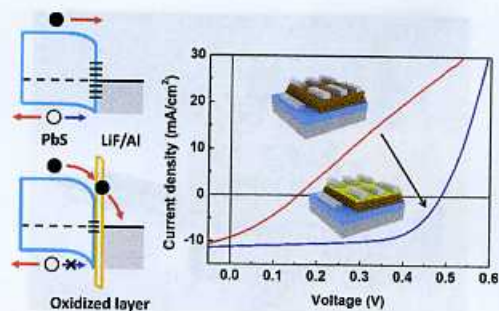
Semi-crystalline photovoltaic polymers with efficiency exceeding 9% in a ~300 nm thick conventional single-cell device

T. L. Nguyen, H. Choi, S.-J. Ko, M. A. Uddin, B. Walker, S. Yum, J.-E. Jeong, M. H. Yun, T. J. Shin, S. Hwang, J. Y. Kim* and H. Y. Woo*

New semi-crystalline photovoltaic polymers were synthesized and the optimized device exhibited 9.39% efficiency in a ~300 nm thick single-cell device.



3052

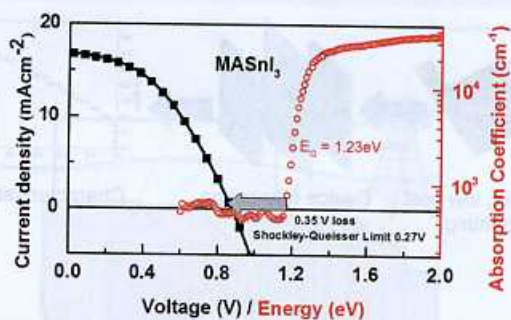


Tailoring of the PbS/metal interface in colloidal quantum dot solar cells for improvements of performance and air stability

Min-Jae Choi, Jihun Oh, Jung-Keun Yoo, Jaesuk Choi, Dong Min Sim and Yeon Sik Jung*

Tailoring the PbS/metal interface with an ultrathin oxidized layer improves both the efficiency and stability of quantum dot solar cells.

3061

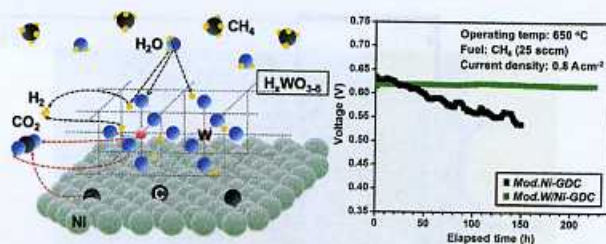


Lead-free organic-inorganic tin halide perovskites for photovoltaic applications

N. K. Noel, S. D. Stranks, A. Abate, C. Wehrenfennig, S. Guarnera, A.-A. Haghighirad, A. Sadhanala, G. E. Eperon, S. K. Pathak, M. B. Johnston, A. Petrozza, L. M. Herz and H. J. Snaith*

Perovskite solar cells based on abundant low cost materials promise to compete on performance with mainstream PV. Here we demonstrate lead-free perovskite solar cells, removing a potential barrier to widespread deployment.

3069

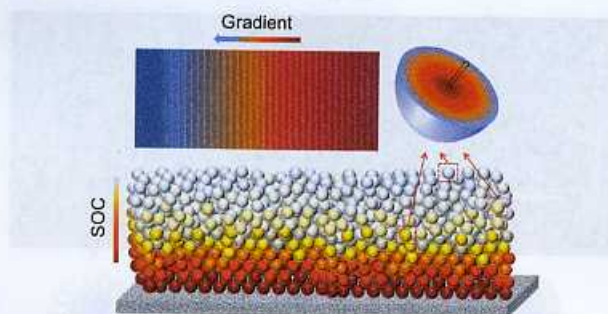


Hydrogen tungsten bronze as a decoking agent for long-life, natural gas-fueled solid oxide fuel cells

Daeil Yoon and Arumugam Manthiram*

$H_xWO_{3-\delta}$ ($\equiv WO_{3-x-\delta}(OH)_x$) formed by reaction with the water vapor by-product enables the Ni-based anodes to operate with hydrocarbon fuels.

3077



Profiling the nanoscale gradient in stoichiometric layered cathode particles for lithium-ion batteries

Feng Lin,* Dennis Nordlund, Isaac M. Markus, Tsu-Chien Weng, Huolin L. Xin* and Marca M. Doeff*

Charge inhomogeneity in battery particles is investigated using ensemble-averaged and spatially resolved core-level spectroscopies as well as atomic imaging.

Cost analysis of roll-to-roll fabricated TFO free single and tandem organic solar modules based on data from manufacture

Florian Macchi, Martin Hezel, Ming Li, George D. Spyropoulos, Jochen A. Röger, Michael J. Heuser, Daniel Lasser, Daniel Scher, Daniel G. Cahill, Daniel Lasser, Matthias Leber, Nicola Lemaire, Marc V. Meyer, Daniel G. Cahill, and Patrick C. Hueck

We present a cost analysis based on data from the roll-to-roll fabrication of single and tandem organic solar modules. The analysis is based on a detailed cost breakdown of the manufacturing process, including materials, labor, and overheads. The results show that the cost of single and tandem organic solar modules is significantly lower than that of silicon solar modules, and is comparable to that of thin-film solar modules. The analysis also identifies the main cost drivers in the manufacturing process, and provides a roadmap for further cost reduction.

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