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See Félix Urbain *et al.*,
pp. 145-154.
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Inside cover
See Tae-Woo Lee *et al.*,
pp. 12-30.
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REVIEWS

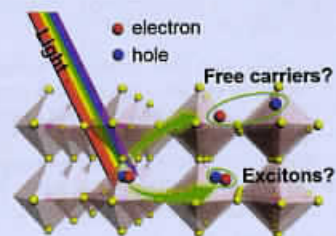
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Planar heterojunction organometal halide perovskite solar cells: roles of interfacial layers

Hobeom Kim, Kyung-Geun Lim and Tae-Woo Lee*

This review article gives an overview of progress in planar heterojunction perovskite solar cells and the roles of interfacial layers in the device, and suggests a practical strategy to fabricate highly efficient and flexible planar heterojunction perovskite solar cells.

Flexible planar heterojunction perovskite solar cells

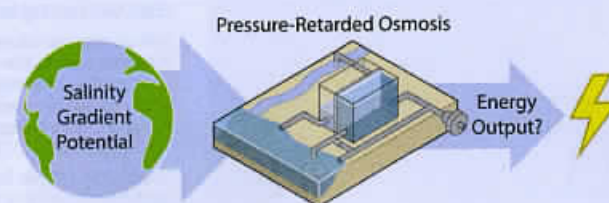


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Pressure-retarded osmosis for power generation from salinity gradients: is it viable?

Anthony P. Straub, Akshay Deshmukh and Menachem Elimelech*

We review pressure-retarded osmosis focusing on the net energy extractable from the process and the ultimate viability of various configurations.



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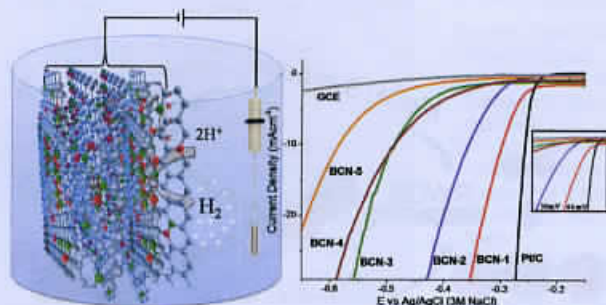


Highly efficient, large area, roll coated flexible and rigid OPV modules with geometric fill factors up to 98.5% processed with commercially available materials

L. Lucera,* F. Machui, P. Kubis, H. D. Schmidt, J. Adams, S. Strohm, T. Ahmad, K. Forberich, H.-J. Egelhaaf* and C. J. Brabec

Flexible roll-coated and rigid organic PV modules, solution processed on a large area, are reported with efficiencies of 4.2% and 5.3%, respectively.

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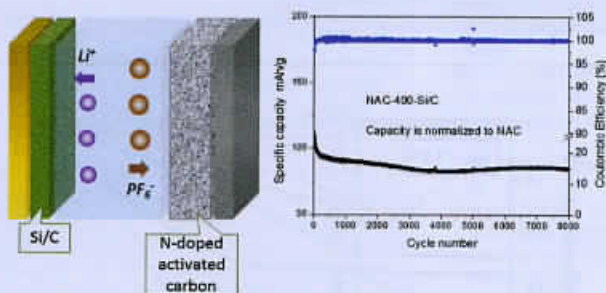


Superior performance of borocarbonitrides, $B_xC_yN_z$, as stable, low-cost metal-free electrocatalysts for the hydrogen evolution reaction

Manjeet Chhetri, Somak Maitra, Himanshu Chakraborty, Umesh V. Waghmare and C. N. R. Rao*

We report superior hydrogen evolution activity of metal-free borocarbonitride (BCN) catalysts.

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Nitrogen-doped activated carbon for a high energy hybrid supercapacitor

Bing Li, Fang Dai, Qiangfeng Xiao, Li Yang, Jingmei Shen, Cunman Zhang* and Mei Cai*

The present work provides a novel one-step synthesis for nitrogen-doped activated carbon. The excellent performance of the N-doped AC allows its further application in a hybrid-type supercapacitor, which utilizes a combination of the capacitor electrode and a Li-ion battery anode.

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Metal-organic-framework-engaged formation of Co nanoparticle-embedded carbon@ Co_9S_8 double-shelled nanocages for efficient oxygen reduction

Han Hu, Lei Han, Mengzhou Yu, Zhiyu Wang* and Xiong Wen (David) Lou*

Rationally designed Co nanoparticle-embedded carbon@ Co_9S_8 double-shelled nanocages exhibit excellent electrocatalytic performance for the oxygen reduction reaction.

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A soft, multilayered...

Claudiu B. Bucu, John Muldoon

It is desirable to have a material that is flexible and self-healing, and that expands during operation to impede electro...

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Energy saving bistable low-voltage...

Haijin Shin, Seungmin Han

Energy saving bistable low-voltage electrochromic devices are reported. Controlling the electrochromic level (E_{HOMO}) of the bistable electrochromic electrolyte layer at the voltage of 0.7 V ($879 \text{ cm}^2 \text{ C}^{-1}$)...

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Single layer of 2D metals as high energy water oxidizers...

Xiaojun Cui, Pengfei Xinhe Bao*

Single layer of 2D metals as high energy water oxidizers are reported. The 3d transition metal and durability...

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Molecular- $CuIn(S,Se)_2$ solar cells

A. R. Uhl,* J. J....

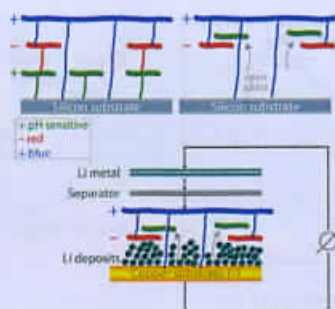
Metal-organic framework (MOF) oxidation state composition...

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A soft, multilayered lithium–electrolyte interface

Claudiu B. Bucur, Adrian Lita, Naoki Osada and John Muldoon*

It is desirable that a thin film lithium–electrolyte interface is flexible and self-healing to accommodate the large volume expansion during lithium deposition without rupturing and impede electrolyte decomposition.

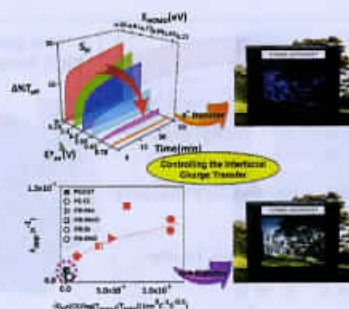


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Energy saving electrochromic windows from bistable low-HOMO level conjugated polymers

Haijin Shin, Seogjae Seo, Chihyun Park, Jongbeom Na, Minsu Han and Eunkyong Kim*

Energy saving electrochromic windows were achieved by controlling the interfacial charge transfer using low-HOMO level ($E_{\text{HOMO}} < -5$ eV) π -conjugated polymers (CPs) as bistable electrochromic films and an ionic liquid as the electrolyte layer. It provided a long bistability (>90 min) at the voltage-off state with a high coloration efficiency ($879 \text{ cm}^2 \text{ C}^{-1}$).

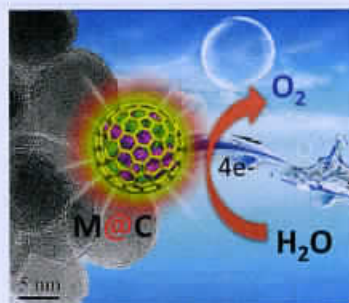


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Single layer graphene encapsulating non-precious metals as high-performance electrocatalysts for water oxidation

Xiaoju Cui, Pengju Ren, Dehui Deng,* Jiao Deng and Xinhe Bao*

Single layer graphene encapsulating earth-abundant 3d transition metal nanoparticles exhibits excellent activity and durability for water oxidation, even exceeding IrO_2 .



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Molecular-ink route to 13.0% efficient low-bandgap $\text{CuIn}(\text{S,Se})_2$ and 14.7% efficient $\text{Cu}(\text{In,Ga})(\text{S,Se})_2$ solar cells

A. R. Uhl,* J. K. Katahara and H. W. Hillhouse*

Metal–organic complexes were found critical to control oxidation states, loss of metals during processing, and the composition of the absorber.

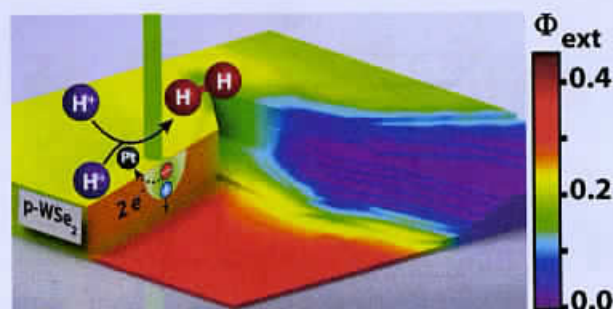


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A scanning probe investigation of the role of surface motifs in the behavior of p-WSe₂ photocathodes

Jesus M. Velazquez, Jimmy John, Daniel V. Esposito, Adam Pieterick, Ragip Pala, Guofeng Sun, Xinghao Zhou, Zhuangqun Huang, Shane Ardo, Manuel P. Soriaga, Bruce S. Brunschwig and Nathan S. Lewis*

Microscale *in situ* interrogation of the photoelectrochemical performance of pristine and Pt-covered p-WSe₂ photocathodes was studied by scanning photocurrent microscopy.

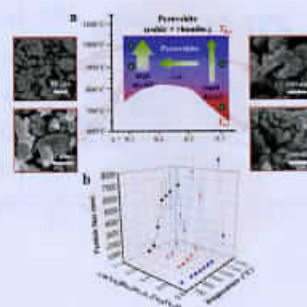


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Optimizing nanoparticle perovskite for bifunctional oxygen electrocatalysis

Jae-Il Jung, Marcel Risch, Seungkyu Park, Min Gyu Kim, Gyutae Nam, Hu-Young Jeong, Yang Shao-Horn* and Jaephil Cho*

The successful synthesis of bifunctional perovskite electrocatalysts ~50 nm in size towards the development of energy storage systems with high power density is presented.

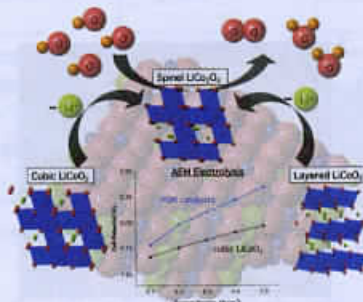


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Structural basis for differing electrocatalytic water oxidation by the cubic, layered and spinel forms of lithium cobalt oxides

Graeme Gardner, Jafar Al-Sharab, Nemanja Danilovic, Yong Bok Go, Katherine Ayers, Martha Greenblatt and G. Charles Dismukes*

Comparison of the OER activity of cubic and layered LiCoO₂ shows a convergence to the catalytically active LiCo₂O₄ spinel phase, which demonstrates excellent performance in membrane-based alkaline electrolysis.

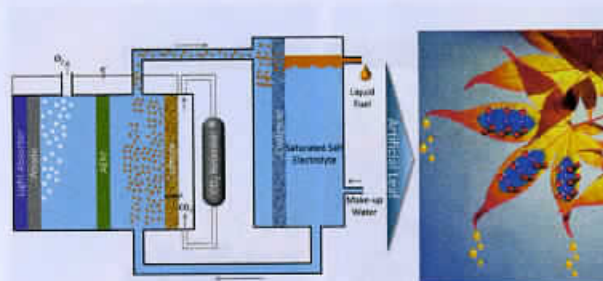


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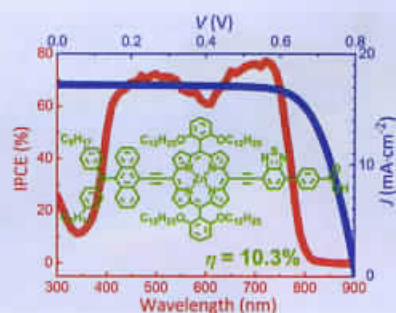
Design of an artificial photosynthetic system for production of alcohols in high concentration from CO₂

Meenesh R. Singh and Alexis T. Bell*

The design for a novel artificial photosynthetic system is proposed that can be ten-fold more efficient than natural photosynthesis and produce almost pure liquid fuel.



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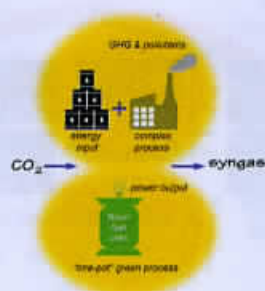


Porphyrins bearing a consolidated anthryl donor with dual functions for efficient dye-sensitized solar cells

Chin-Li Wang, Min Zhang, Yu-Hsin Hsiao, Chuan-Kai Tseng, Chia-Lin Liu, Mingfei Xu, Peng Wang* and Ching-Yao Lin*

Efficient DSSC performance was achieved by using a porphyrin dye bearing a consolidated anthryl donor which provides both electron-donating and absorption-broadening effects.

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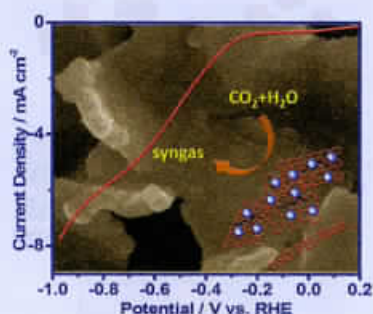


Novel layered solid oxide fuel cells with multiple-twinned $\text{Ni}_{0.8}\text{Co}_{0.2}$ nanoparticles: the key to thermally independent CO_2 utilization and power-chemical cogeneration

Bin Hua, Ning Yan, Meng Li, Ya-qian Zhang, Yi-fei Sun, Jian Li, Thomas Etsell, Partha Sarkar, Karl Chuang and Jing-Li Luo*

To energy-efficiently offset our carbon footprint, we developed a layered H-SOFC with multiple-twinned $\text{Ni}_{0.8}\text{Co}_{0.2}$ nanoparticles, achieving three milestones: CO_2 utilization, electricity generation and syngas production.

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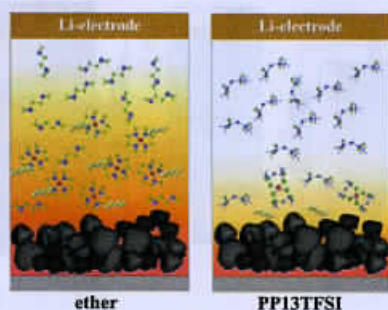


Polyethylenimine promoted electrocatalytic reduction of CO_2 to CO in aqueous medium by graphene-supported amorphous molybdenum sulphide

Fengwang Li, Shu-Feng Zhao, Lu Chen, Azam Khan, Douglas R. MacFarlane* and Jie Zhang*

Amorphous molybdenum sulphide immobilized on polyethylenimine modified reduced graphene oxide can catalyse the electroreduction of CO_2 to CO or "syngas" in aqueous media with high efficiency.

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To mitigate self-discharge of lithium-sulfur batteries by optimizing ionic liquid electrolytes

Lina Wang, Jingyuan Liu, Shouyi Yuan, Yonggang Wang* and Yongyao Xia*

Here we demonstrate pronounced suppression of self-discharge using an ionic liquid of *N*-methyl-*N*-propyl-piperidinium bis(trifluoromethanesulfonyl)imide-based electrolytes for Li-S batteries.

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Geometrical high gravimetric supercapacitors

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Highly efficient solar cells

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Open circuit organic photovoltaic

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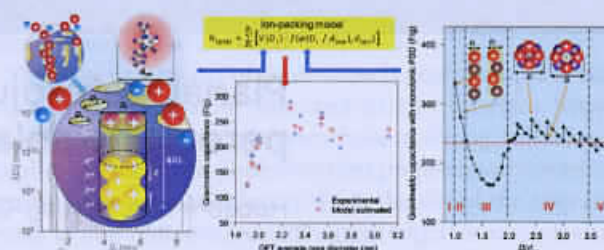
We developed voltage and through exp...

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Geometrically confined favourable ion packing for high gravimetric capacitance in carbon–ionic liquid supercapacitors

Xuehang Wang, Haitao Zhou, Edel Sheridan, John Charles Walmsley, Dingding Ren and De Chen*

The specific energy of carbon–ionic liquid supercapacitors comparable to NiMH batteries has been achieved by a combined modeling and experimental approach.

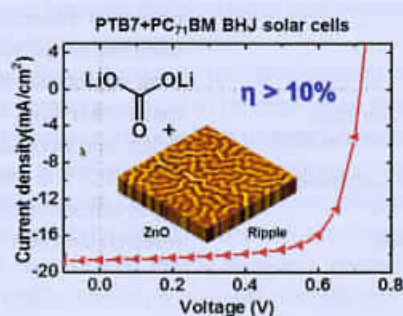


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Highly efficient inverted bulk-heterojunction solar cells with a gradiently-doped ZnO layer

Sungho Nho, Gyoelim Baek, Sujung Park, Bo Ram Lee, Myung Joo Cha, Dong Chan Lim, Jung Hwa Seo, Seung-Hwan Oh, Myoung Hoon Song and Shinuk Cho*

Highly efficient inverted BHJ solar cells were demonstrated using a wet-chemically prepared doped ZnO layer with a self-organized ripple nanostructure. The solar cell based on PTB7 and PC₇₁BM with Li₂CO₃-doped ZnO layer yielded a maximum efficiency of 10.08%.

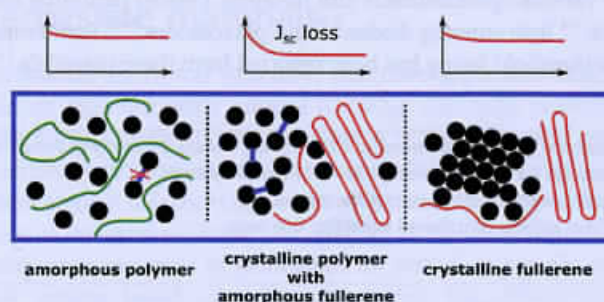


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Morphological and electrical control of fullerene dimerization determines organic photovoltaic stability

Thomas Heumueller, William R. Mateker, Andreas Distler, Urs F. Fritze, Rongrong Cheacharoen, William H. Nguyen, Markus Biele, Michael Salvador, Max von Delius, Hans-Joachim Egelhaaf, Michael D. McGehee* and Christoph J. Brabec*

Light induced fullerene dimerization is controlled by both the fullerene and polymer morphology of organic solar cells.



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Open circuit voltage and efficiency in ternary organic photovoltaic blends

N. Felekidis, E. Wang* and M. Kemerink*

We develop the understanding of the open circuit voltage and efficiency in ternary organic solar cells through experiments and quantitative modeling.

