

Energy & Environmental Science

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Cover
See Hou, Li, Zhan *et al.*,
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See Liu, Kang *et al.*,
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EDITORIAL

Two stories from the ISACS 12 conference: solar-fuel devices and catalyst identification

Zhuangqun Huang, Chengxiang Xiang,
Hans-Joachim Lewerenz and Nathan S. Lewis*

The International Symposia for advancing the Chemical Sciences, a partner of the journal *Chemical Science*, held its 12th meeting (ISACS 12) at the University of Cambridge on September 3–6 2013. ISACS 12 focused on "Challenges in Chemical Renewable Energy".



REVIEWS

Recent progress on nitrogen/carbon structures designed for use in energy and sustainability applications

Kevin N. Wood, Ryan O'Hayre and Svitlana Pylypenko*

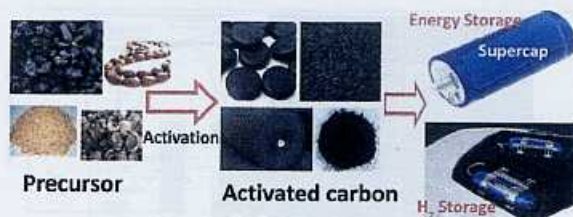
Nitrogen modification of carbon structures is making a vast impact across the scientific community, specifically in the realms of energy and sustainability.



Energy storage applications of activated carbons: supercapacitors and hydrogen storage

Marta Sevilla* and Robert Mokaya*

This review presents the state-of-the-art with respect to synthesis of activated carbons, and their use as electrode materials in supercapacitors and as hydrogen storage materials.



Recent advances in multifunctional nanocarbons used in dye-sensitized solar cells

Rubén D. Costa, Fabian Lodermeier, Rubén Casillas and Dirk M. Guldi*

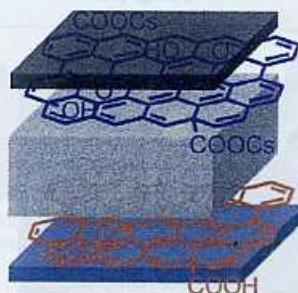
This review highlights DSSC technology, in general, and recent strategies to implement carbon nanomaterials into the different parts of DSSC, in particular.



Graphene oxide derivatives as hole- and electron-extraction layers for high-performance polymer solar cells

Jun Liu,* Michael Durstock and Liming Dai*

Graphene oxide is a new-emerging material as a charge extraction layer in polymer solar cells with excellent device performance.



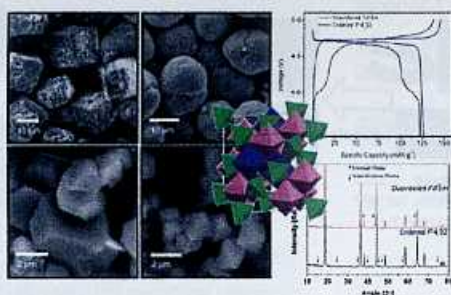
Progress in flexible lithium batteries and future prospects

Guangmin Zhou, Feng Li and Hui-Ming Cheng*

Recent progress in the production of flexible solid-state electrolytes and electrode materials for the development of flexible lithium batteries and their future prospects are comprehensively summarized.



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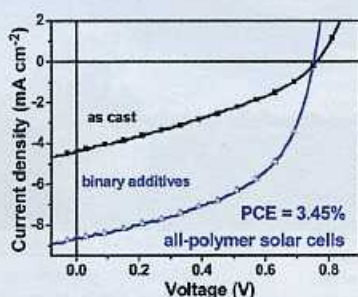


A perspective on the high-voltage $\text{LiMn}_{1.5}\text{Ni}_{0.5}\text{O}_4$ spinel cathode for lithium-ion batteries

Arumugam Manthiram,* Katharine Chemelewski and Eun-Sung Lee

A perspective on the current understanding of the factors controlling the electrochemical performances and future directions of high-voltage spinel cathodes.

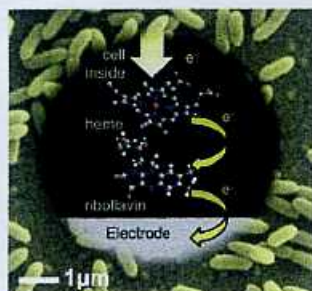
COMMUNICATIONS



Binary additives synergistically boost the efficiency of all-polymer solar cells up to 3.45%

Pei Cheng, Long Ye, Xingang Zhao, Jianhui Hou,* Yongfang Li* and Xiaowei Zhan*

Binary additives of PDI-2DTT and DIO synergistically boost the power conversion efficiency of all-polymer solar cells up to 3.45%.

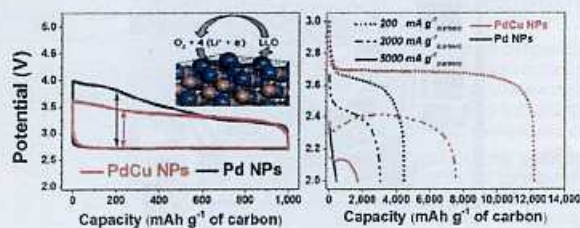


Uptake of self-secreted flavins as bound cofactors for extracellular electron transfer in *Geobacter* species

Akihiro Okamoto, Koichiro Saito, Kengo Inoue, Kenneth H. Nealson, Kazuhito Hashimoto* and Ryuhei Nakamura*

Geobacter cells utilize self-secreted riboflavin as a bound-cofactor in outer-membrane c-type cytochromes to enhance the rate of bacterial electron transport.

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Ultra-low overpotential and high rate capability in Li-O_2 batteries through surface atom arrangement of PdCu nanocatalysts

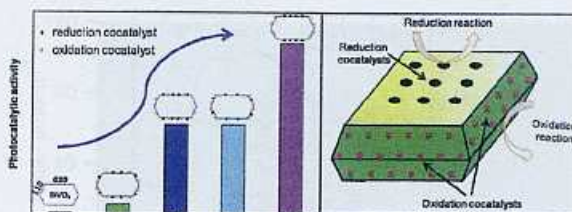
Ran Choi, Jaepyeong Jung, Gyubong Kim, Kyeongse Song, Yong-Il Kim, Sung Chul Jung, Young-Kyu Han,* Hyunjoon Song* and Yong-Mook Kang*

PdCu nanoparticles enhance the kinetics of oxygen reduction/evolution reaction through significant reduction of overpotentials finally demonstrating a remarkable high rate capability for Li-O_2 cells.

Highly efficient photocatalysts constructed by rational assembly of dual-cocatalysts separately on different facets of BiVO₄

Rengui Li, Hongxian Han, Fuxiang Zhang, Donge Wang and Can Li*

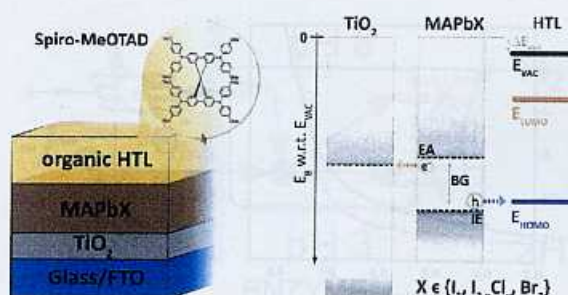
Rational construction of dual cocatalysts corresponding to different facets with photogenerated charge separation.



Interface energetics in organo-metal halide perovskite-based photovoltaic cells

Philip Schulz,* Eran Edri, Saar Kirmayer, Gary Hodes, David Cahen and Antoine Kahn*

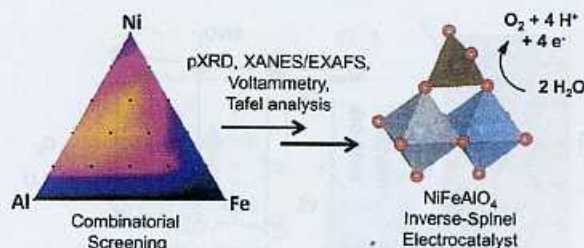
Complete, directly measured electronic energy diagram including energy level alignment for methylammonium lead trihalide perovskite based solar cells.



Inverse spinel NiFeAlO₄ as a highly active oxygen evolution electrocatalyst: promotion of activity by a redox-inert metal ion

Jamie Y. C. Chen, Jeffrey T. Miller, James B. Gerken and Shannon S. Stahl*

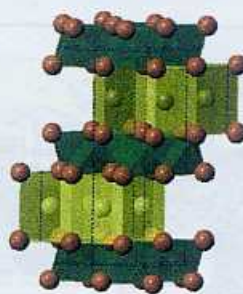
The inverse spinel NiFeAlO₄ is a significantly more active water oxidation electrocatalyst than NiO and NiFe-based oxides.

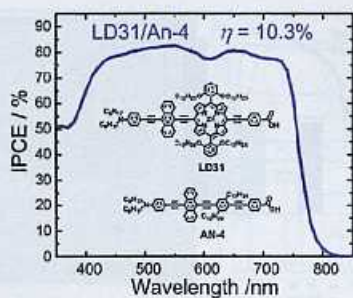


Na_{0.67}Mn_{1-x}Mg_xO₂ (0 ≤ x ≤ 0.2): a high capacity cathode for sodium-ion batteries

Juliette Billaud, Gurpreet Singh, A. Robert Armstrong, Elena Gonzalo, Vladimir Roddatis, Michel Armand, Teófilo Rojo and Peter G. Bruce*

Earth-abundant Na_{0.67}[Mn_{1-x}Mg_x]O₂ (0 ≤ x ≤ 0.2) cathode materials with the P2 structure have been synthesized as positive electrodes for sodium-ion batteries.

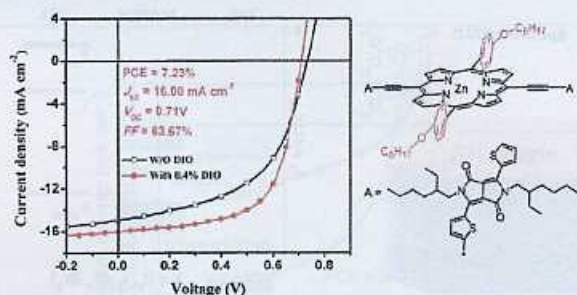




Highly efficient porphyrin-sensitized solar cells with enhanced light harvesting ability beyond 800 nm and efficiency exceeding 10%

Chin-Li Wang, Jyun-Yu Hu, Cheng-Hua Wu, Hshin-Hui Kuo, Yu-Cheng Chang, Zih-Jian Lan, Hui-Ping Wu, Eric Wei-Guang Diao* and Ching-Yao Lin*

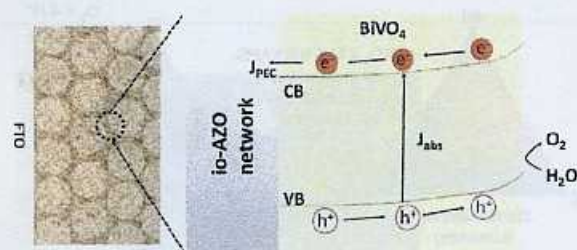
An improved DSSC performance was achieved by co-sensitizing a new porphyrin sensitizer with a novel organic dye on an optimized photoanode.



Solution-processed bulk heterojunction solar cells based on a porphyrin small molecule with 7% power conversion efficiency

Hongmei Qin, Lisheng Li, Fangqing Guo, Shijian Su, Junbiao Peng, Yong Cao and Xiaobin Peng*

Solution-processed BHJ solar cells based on a porphyrin small molecule as the donor material exhibit a PCE of up to 7.23%.

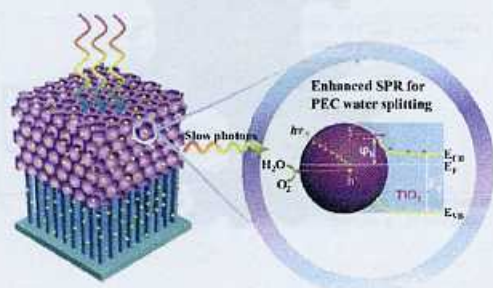


Al-doped ZnO inverse opal networks as efficient electron collectors in BiVO₄ photoanodes for solar water oxidation

Liwu Zhang, Erwin Reisner* and Jeremy J. Baumberg*

A conductive Al-doped ZnO inverse opal network has been introduced into BiVO₄ photoanode to improve photogenerated electron transport and collection.

PAPERS



Coupling surface plasmon resonance of gold nanoparticles with slow-photon-effect of TiO₂ photonic crystals for synergistically enhanced photoelectrochemical water splitting

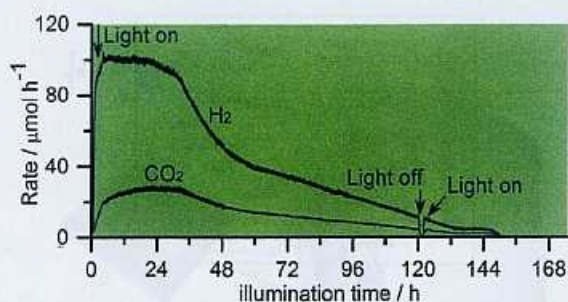
Xing Zhang, Yang Liu,* Shuit-Tong Lee, Shihe Yang and Zhenhui Kang*

Amplified SPR intensity for plasmonic PEC water splitting by coupling slow photons in TiO₂ photonic crystals.

Long-term investigation of the photocatalytic hydrogen production on platynized TiO₂: an isotopic study

Tarek A. Kandiel,* Irina Ivanova and Detlef W. Bahnemann

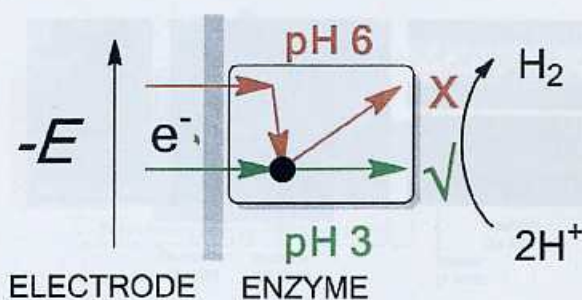
Methanol acts as an electron donor and the photocatalytically evolved hydrogen is mainly produced by the reduction of protons originating from water.



Transforming an oxygen-tolerant [NiFe] uptake hydrogenase into a proficient, reversible hydrogen producer

Bonnie J. Murphy, Frank Sargent and Fraser A. Armstrong*

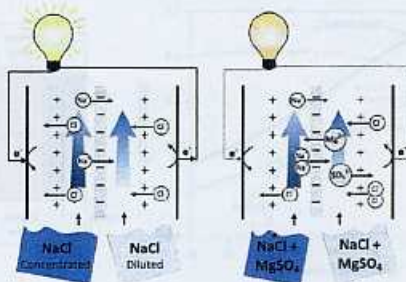
Special 'O₂-tolerant' [NiFe]-hydrogenases that appear only to catalyse H₂ oxidation are transformed into efficient bidirectional H₂ producers by adjusting the potential differential within the enzyme.



Influence of multivalent ions on renewable energy generation in reverse electrodiolysis

David A. Vermaas, Joost Veerman, Michel Saakes and Kitty Nijmeijer*

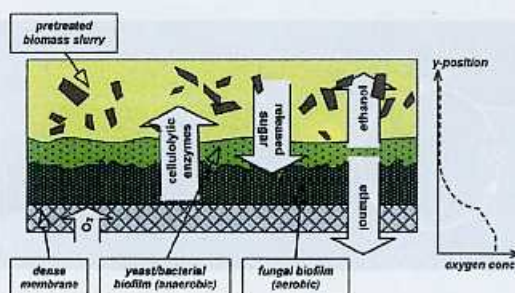
Renewable energy obtained from mixing seawater and river water is strongly influenced by the presence of multivalent ions in the feed waters.

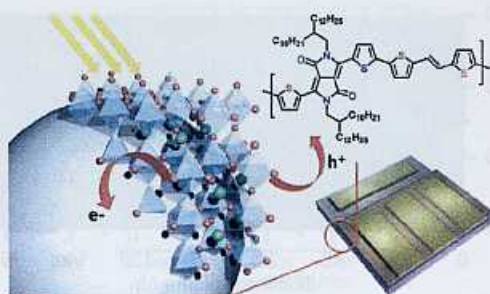


Consolidated bioprocessing of lignocellulose by a microbial consortium

Simone Brethauer and Michael Hanspeter Studer*

Cellulose and hemicellulose of pretreated wheat straw were directly converted to ethanol by the combined action of *Trichoderma reesei*, *Saccharomyces cerevisiae* and *Scheffersomyces stipitis* growing in a biofilm membrane reactor featuring both aerobic and anaerobic conditions.





A diketopyrrolopyrrole-containing hole transporting conjugated polymer for use in efficient stable organic-inorganic hybrid solar cells based on a perovskite

Young Soo Kwon, Jongchul Lim, Hui-Jun Yun, Yun-Hi Kim* and Taiho Park*

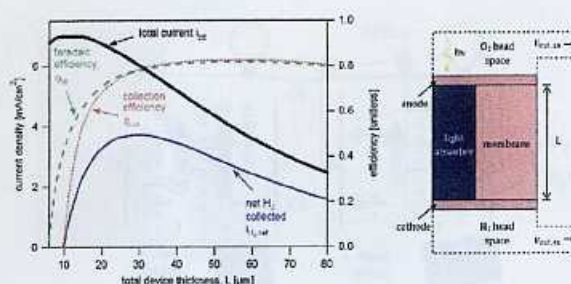
D- π -A conjugated polymers successfully incorporated into perovskite-based organic-inorganic hybrid solar cells, outperforming the best ever spiro-MeOTAD hole transporting material.



Optically transparent hydrogen evolution catalysts made from networks of copper-platinum core-shell nanowires

Zuofeng Chen, Shengrong Ye, Adria R. Wilson, Yoon-Cheol Ha and Benjamin J. Wiley*

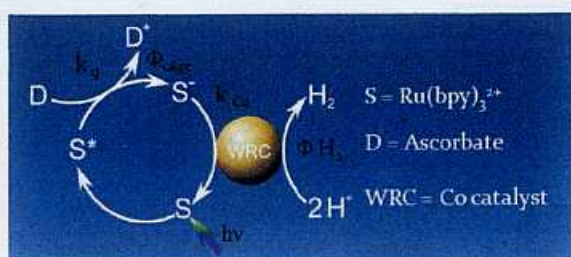
This article reports the fabrication of copper-platinum core-shell nanowires by electroplating platinum onto copper nanowires, and the first demonstration of their use as a transparent, conducting electrocatalyst for the hydrogen evolution reaction (HER).



Material requirements for membrane separators in a water-splitting photoelectrochemical cell

Alan Berger,* R. A. Segalman and J. Newman*

Effects of gas crossover on photoelectrochemical hydrogen production efficiency are shown, setting targets for material properties of membrane separators.



Towards a comprehensive understanding of visible-light photogeneration of hydrogen from water using cobalt(II) polypyridyl catalysts

R. S. Khayzer, V. S. Thoi, M. Nippe, A. E. King, J. W. Jurss, K. A. El Roz, J. R. Long,* C. J. Chang* and F. N. Castellano*

Numerous visible-light absorbing homogeneous photocatalytic compositions are shown to produce copious amounts of hydrogen gas from pure water.

