

Energy & Environmental Science

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IN THIS ISSUE

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Cover

See Lin *et al.*,
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Energy & Environmental Science



Inside cover

See Darling *et al.*,
pp. 1513–1520.
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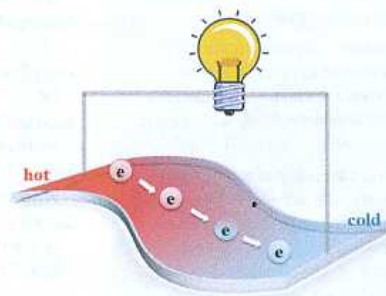
REVIEWS

1352

Towards high-performance polymer-based thermoelectric materials

Ming He, Feng Qiu and Zhiqun Lin*

Recent advances in the preparation, modification and optimization of polymer thermoelectric materials are reviewed.

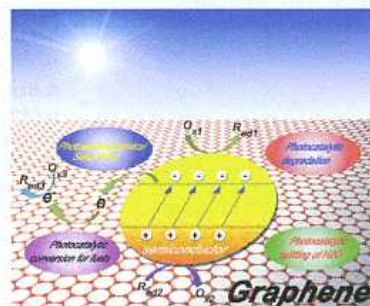


1362

Graphene and its derivatives for the development of solar cells, photoelectrochemical, and photocatalytic applications

Da Chen, Hao Zhang, Yang Liu and Jinghong Li*

This review explores and summarizes the exciting recent progress on the use of graphene-based materials for photoelectrochemical applications.

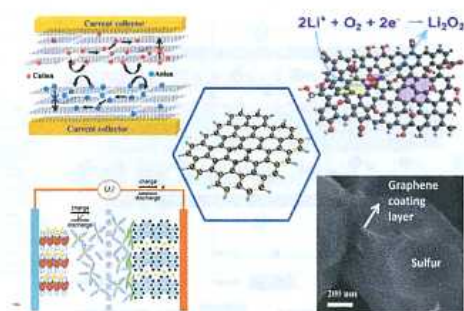


1388

Graphene-based electrodes for electrochemical energy storage

Chaohe Xu, Binghui Xu, Yi Gu, Zhigang Xiong, Jing Sun and X. S. Zhao*

This review article discusses recent advancements in graphene-based electrodes for electrochemical energy storage.

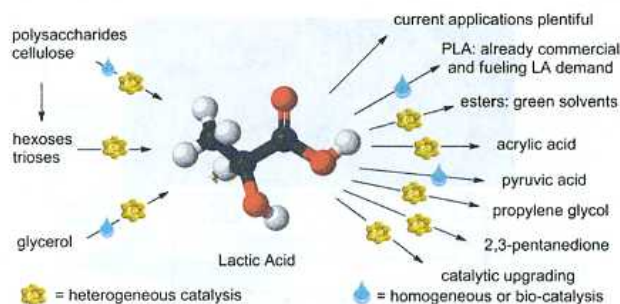


1415

Lactic acid as a platform chemical in the biobased economy: the role of chemocatalysis

Michiel Dusselier,* Pieter Van Wouwe, Annelies Dewaele, Ekaterina Makshina and Bert F. Sels*

Novel catalytic processes to produce lactic acid and its conversion towards value added chemicals in a platform approach are reviewed.



PERSPECTIVE

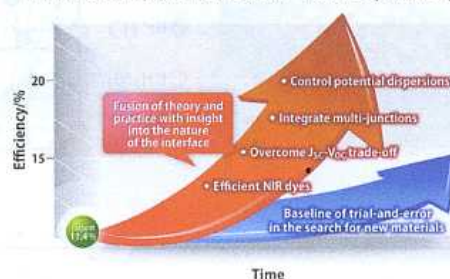
1443

Highly efficient dye-sensitized solar cells: progress and future challenges

Shufang Zhang, Xudong Yang, Youhei Numata and Liyuan Han*

Recent promising achievements and the routes to high efficiency dye-sensitized solar cells (DSCs) for practical applications in the future.

Future direction of DSCs — Efficiency Roadmap —



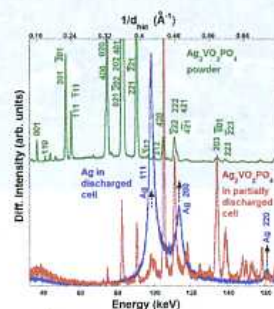
COMMUNICATIONS

1465

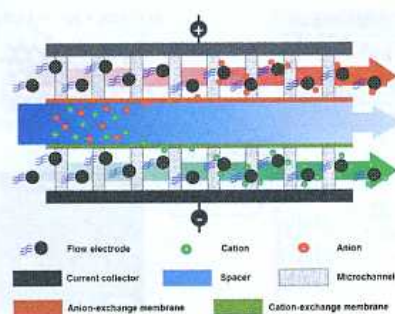
Energy dispersive X-ray diffraction of lithium–silver vanadium phosphorous oxide cells: *in situ* cathode depth profiling of an electrochemical reduction–displacement reaction

Esther S. Takeuchi,* Amy C. Marschilok,* Kenneth J. Takeuchi,* Alexander Ignatov, Zhong Zhong and Mark Croft*

The first *in situ* EDXRD of a cathode within an intact Li-anode cell allows dimensional resolution of reaction progress within a battery and within an electrode.



1471

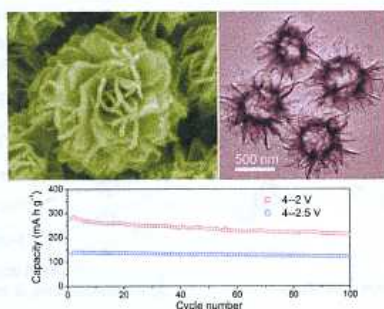


Desalination via a new membrane capacitive deionization process utilizing flow-electrodes

Sung-il Jeon, Hong-ran Park, Jeong-gu Yeo, SeungCheol Yang, Churl Hee Cho, Moon Hee Han* and Dong Kook Kim*

A capacitive deionization process utilizing flow-electrodes (FCDI) was designed and evaluated for use in seawater desalination.

1476

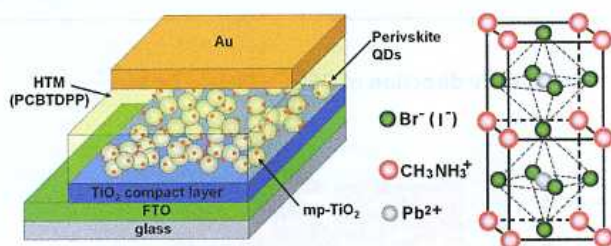


Uniform V₂O₅ nanosheet-assembled hollow microflowers with excellent lithium storage properties

An Qiang Pan, Hao Bin Wu, Lei Zhang and Xiong Wen (David) Lou*

Hierarchical V₂O₅ nanosheet-assembled hollow microflowers exhibit excellent lithium storage properties with high capacity and superior cycling stability.

1480

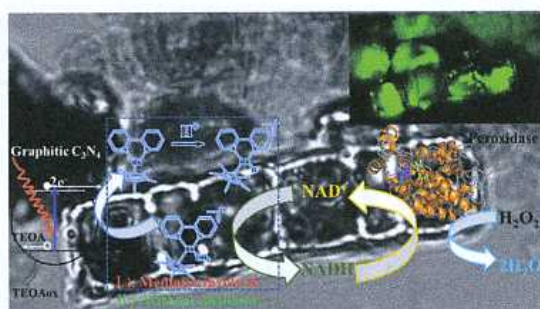


High performance hybrid solar cells sensitized by organolead halide perovskites

Bing Cai, Yedi Xing, Zhou Yang, Wen-Hua Zhang* and Jieshan Qiu*

Solid state solar cells with CH₃NH₃PbX₃ as sensitizers and PCBTDP as a hole transporting material were demonstrated to show high performance.

1486



Bio-inspired NADH regeneration by carbon nitride photocatalysis using diatom templates

Jian Liu* and Markus Antonietti

In this report, the bio-inspired photocatalytic regeneration of NADH employing graphitic carbon nitride photocatalysis with a diatom frustule structure was presented.

1494

Dependent light to the nanoscale

Sayantika

The shape of the lifetime of semiconductor

1499

Photocatalytic recycling

Avi Bruma and Brenda

Experimental performance of present GaAs cells

1504

Charge transfer hydrogels for iridium

Benjamin Alexander and An

Steady-state Ir(III)-ph

1509

Correlation in alkaline energy

Wenchen and Yu

A volcano of monolayer binding

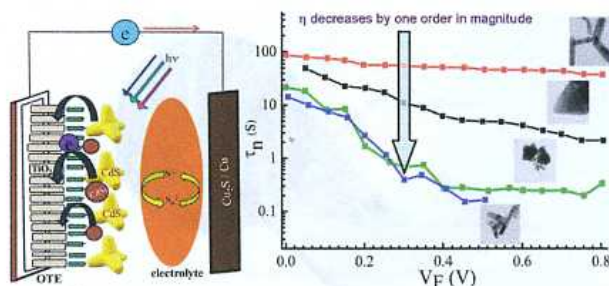
semiconductor

1494

Dependence of electron recombination time and light to electricity conversion efficiency on shape of the nanocrystal light sensitizer

Sayantan Mazumdar and Aninda J. Bhattacharyya*

The shape of a light sensitizer alters electron recombination lifetime and light to electricity conversion efficiency of semiconductor sensitized solar cells.

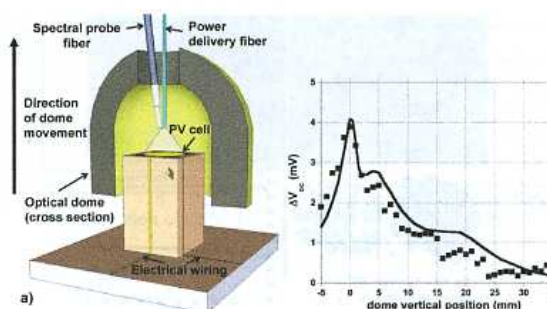


1499

Photovoltaic performance enhancement by external recycling of photon emission

Avi Braun, Eugene A. Katz, Daniel Feuermann, Brendan M. Kayes and Jeffrey M. Gordon*

Experimental evidence of enhancing photovoltaic performance by external recycling of photon emission is presented for today's champion single-junction one sun GaAs cells.

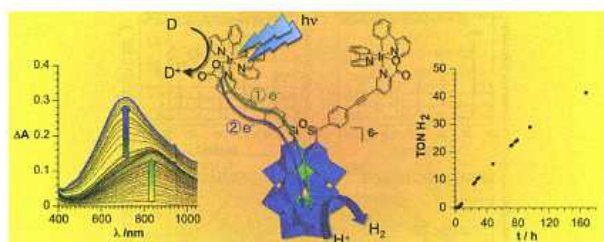


1504

Charge photo-accumulation and photocatalytic hydrogen evolution under visible light at an iridium(III)-photosensitized polyoxotungstate

Benjamin Matt, Jennifer Fize, Jamal Moussa, Hani Amouri, Alexandre Pereira, Vincent Artero, * Guillaume Izzet* and Anna Proust

Steady-state irradiation under visible light of a covalent Ir(III)-photosensitized polyoxotungstate is reported.

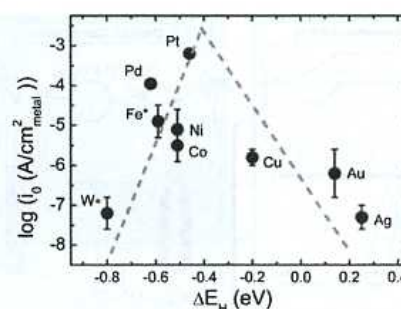


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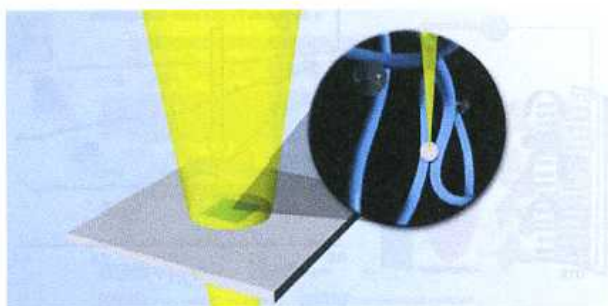
Correlating the hydrogen evolution reaction activity in alkaline electrolytes with the hydrogen binding energy on monometallic surfaces

Wenchao Sheng, MyatNoeZin Myint, Jingguang G. Chen* and Yushan Yan*

A volcano plot of the hydrogen evolution reaction activities of monometallic surfaces as a function of their hydrogen binding energies.



1513

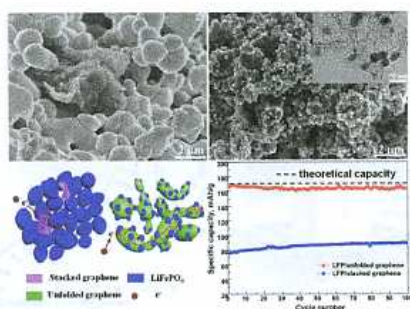


Detection and role of trace impurities in high-performance organic solar cells

Maxim P. Nikiforov, Barry Lai, Wei Chen, Si Chen, Richard D. Schaller, Joseph Strzalka, Jörg Maser and Seth B. Darling*

Synchrotron X-ray fluorescence can detect trace quantities of metal impurities, enabling reproducible high-performance organic solar cells.

1521

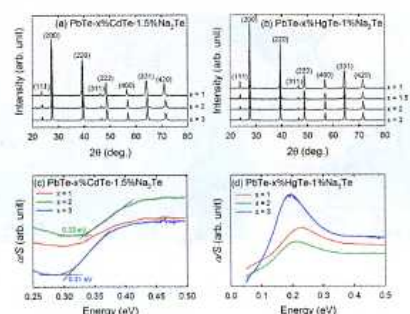


LiFePO₄-graphene as a superior cathode material for rechargeable lithium batteries: impact of stacked graphene and unfolded graphene

Jinli Yang, Jiajun Wang, Yongji Tang, Dongniu Wang, Xifei Li, Yuhai Hu, Ruying Li, Guoxian Liang, Tsun-Kong Sham and Xueliang Sun*

The LiFePO₄-unfolded graphene nanocomposite achieved a discharge capacity of 166.2 mA h g⁻¹ in the 1st cycle, which is 98% of the theoretical capacity, whereas LiFePO₄-stacked graphene only delivers a discharge capacity of 77 mA h g⁻¹.

1529

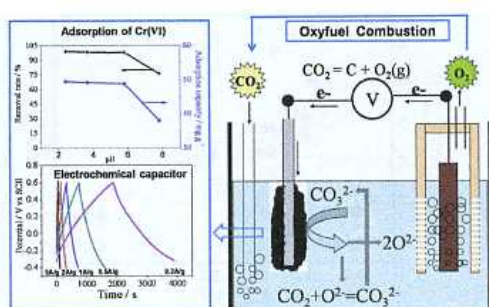


Enhanced thermoelectric properties of p-type nanostructured PbTe-MTe (M = Cd, Hg) materials

Kyunghan Ahn, Kanishka Biswas, Jiaqing He, In Chung, Vinayak Dravid and Mercouri G. Kanatzidis*

We investigated the effect of Cd and Hg substitution on the thermoelectric properties of p-type PbTe-x% CdTe and PbTe-x% HgTe (1 ≤ x ≤ 5) doped with Na₂Te.

1538



Capture and electrochemical conversion of CO₂ to value-added carbon and oxygen by molten salt electrolysis

Huayi Yin, Xuhui Mao, Diyoung Tang, Wei Xiao, Luru Xing, Hua Zhu, Dihua Wang* and Donald R. Sadoway

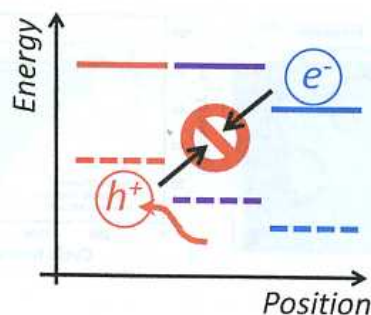
Effectively transforming CO₂ into value-added capacitive carbon and oxygen is demonstrated in a molten salt reactor armed with affordable electrodes.

1546

Suppression of geminate charge recombination in organic photovoltaic devices with a cascaded energy heterojunction

Chris Groves*

A Monte Carlo model is used to investigate the influence of cascaded energy heterojunctions upon geminate charge recombination within organic photovoltaic devices.

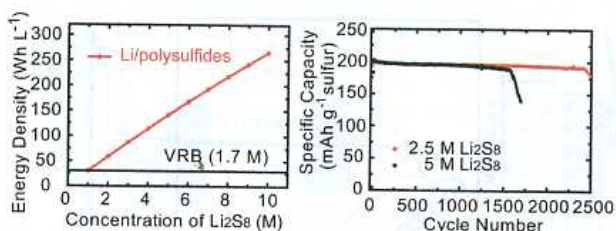


1552

A membrane-free lithium/polysulfide semi-liquid battery for large-scale energy storage

Yuan Yang, Guangyuan Zheng and Yi Cui*

A new lithium/polysulfide (Li/PS) semi-liquid battery is demonstrated with high energy density, long cycle life and low cost.

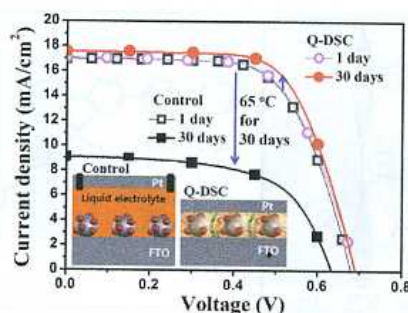


1559

A novel quasi-solid state dye-sensitized solar cell fabricated using a multifunctional network polymer membrane electrolyte

Sung-Hae Park, In Young Song, Jongchul Lim, Young Soo Kwon, Jongmin Choi, Seulki Song, Jae-Ryung Lee and Taiho Park*

The multifunctional network polymer membrane electrolyte for a thin layered device provides short charge transport pathways, better performances, and excellent long-term stability.

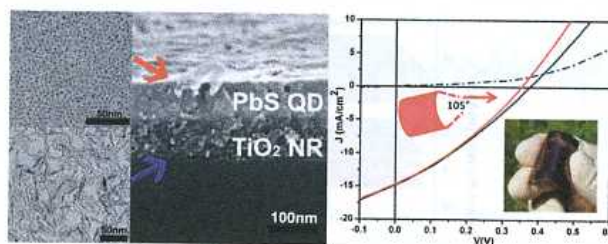


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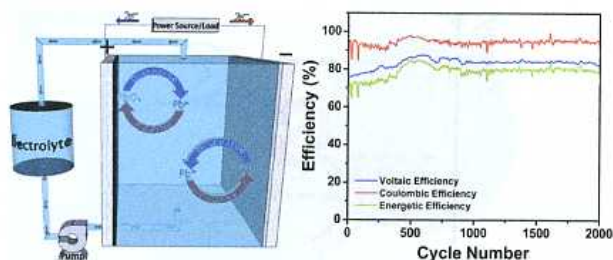
Fabrication of flexible all-inorganic nanocrystal solar cells by room-temperature processing

Anna Loiudice, Aurora Rizzo,* Giulia Grancini, Mariano Biasiucci, Maria R. Belviso, Michela Corricelli, M. Lucia Curri, Marinella Striccoli, Angela Agostiano, P. Davide Cozzoli, Annamaria Petrozza, Guglielmo Lanzani and Giuseppe Gigli

A facile and mild-room temperature solution-based route for the assembly of flexible solar cells via utilization of colloidal semiconductor nanocrystal inks is described.



1573

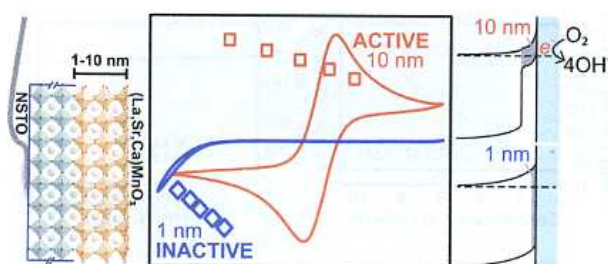


Achieving high efficiency and cyclability in inexpensive soluble lead flow batteries

Michael G. Verde, Kyler J. Carroll, Ziyang Wang, Aaron Sathrum and Ying Shirley Meng*

Demonstration of high efficiency and long cycle life in soluble lead flow batteries.

1582

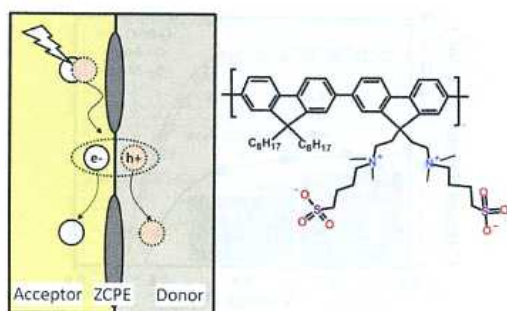


Oxygen electrocatalysis on (001)-oriented manganese perovskite films: Mn valency and charge transfer at the nanoscale

Kelsey A. Stoerzinger, Marcel Risch, Jin Suntivich, W. M. Lü, Jigang Zhou, Michael D. Biegalski, Hans M. Christen, Ariando, T. Venkatesan and Yang Shao-Horn*

The activity of oxygen reduction and ease of charge transfer decrease with manganese perovskite film thickness, attributed to interfacial band bending and Mn reduction by the substrate.

1589

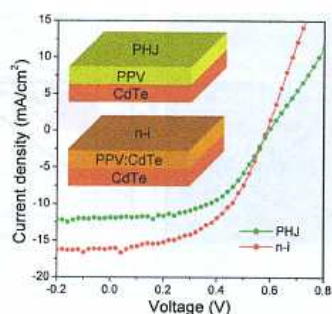


Donor-acceptor interface modification by zwitterionic conjugated polyelectrolytes in polymer photovoltaics

Abhishek Kumar, Giuseppina Pace, Artem A. Bakulin, Junfeng Fang, Peter K. H. Ho, Wilhelm T. S. Huck, Richard H. Friend and Neil C. Greenham*

We report that we can enhance the performance of polymer photovoltaics by introducing materials with dipoles at the donor-acceptor interface of the polymer solar cells.

1597



From planar-heterojunction to n-i structure: an efficient strategy to improve short-circuit current and power conversion efficiency of aqueous-solution-processed hybrid solar cells

Zhaolai Chen, Hao Zhang, Xiaohang Du, Xiao Cheng, Xigao Chen, Yingying Jiang and Bai Yang*

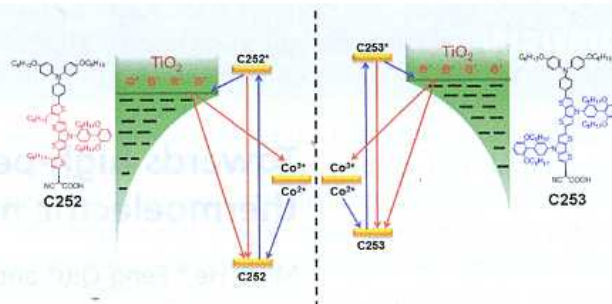
Aqueous-solution-processed hybrid solar cells with n-i structure are fabricated. A PCE of 4.76% and J_{sc} of 16.08 mA cm⁻² are achieved, which are all the highest reported for hybrid solar cells.

1604

Conjugated linker correlated energetics and kinetics in dithienopyrrole dye-sensitized solar cells

Jing Zhang, Zhaoyang Yao, Yanchun Cai, Lin Yang, Mingfei Xu, Renzhi Li,* Min Zhang,* Xiandui Dong and Peng Wang*

We investigated the influence of conjugated linker correlated energetics and kinetics on the photovoltaic behaviors of dye-sensitized solar cells.

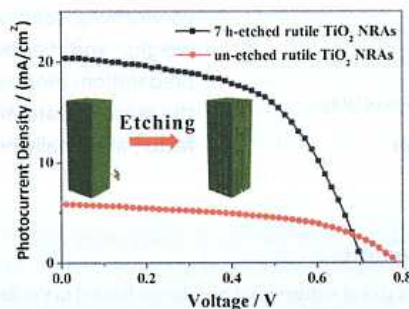


1615

Optimized porous rutile TiO₂ nanorod arrays for enhancing the efficiency of dye-sensitized solar cells

Miaoqiang Lv, Dajiang Zheng, Meidan Ye, Jing Xiao, Wenxi Guo, Yuekun Lai, Lan Sun, Changjian Lin* and Juan Zuo

A facile two-step hydrothermal method is introduced to enhance the internal surface area of one-dimensional rutile TiO₂ nanorod arrays.

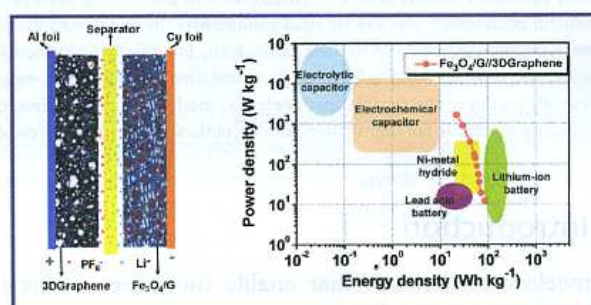


1623

A high-performance supercapacitor-battery hybrid energy storage device based on graphene-enhanced electrode materials with ultrahigh energy density

Fan Zhang, Tengfei Zhang, Xi Yang, Long Zhang, Kai Leng, Yi Huang and Yongsheng Chen*

A high-performance supercapacitor-battery hybrid energy storage device was fabricated based on an Fe₃O₄/G nanocomposite and 3DGraphene electrode materials with ultrahigh energy density.



1633

Stabilizing inorganic photoelectrodes for efficient solar-to-chemical energy conversion

Syed Mubeen, Joun Lee, Nirala Singh, Martin Moskovits and Eric W. McFarland*

A transparent conducting polymer coating for inorganic photoelectrochemical/photosynthetic cells is reported that allows stable production of chemicals from sunlight in highly aggressive acidic electrolytes.

