

## IN THIS ISSUE

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See Lin *et al.*,  
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**Inside cover**  
See Darling *et al.*,  
pp. 1513–1520.  
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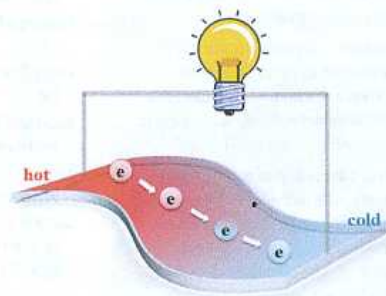
## REVIEWS

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.

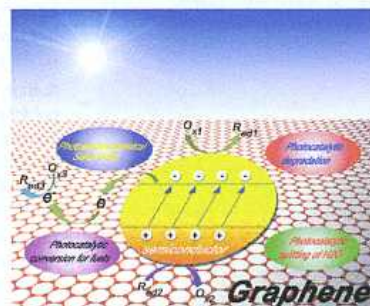


1362

### 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.

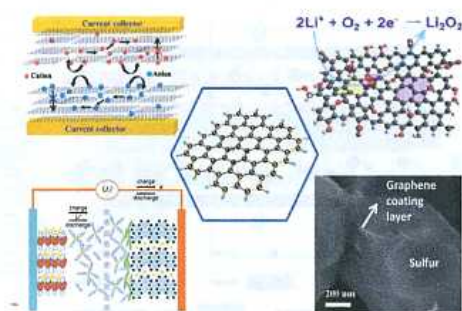


1388

### 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.

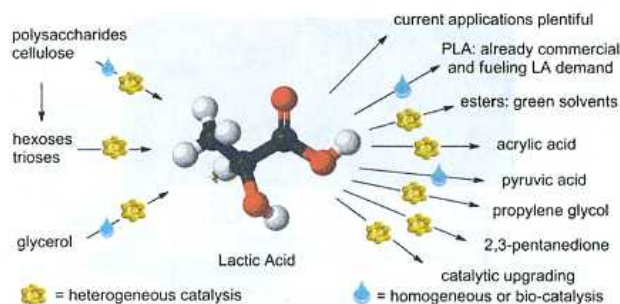


1415

### 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

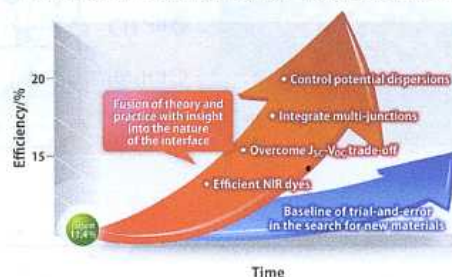
1443

### 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 —



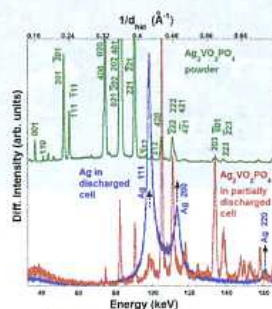
## COMMUNICATIONS

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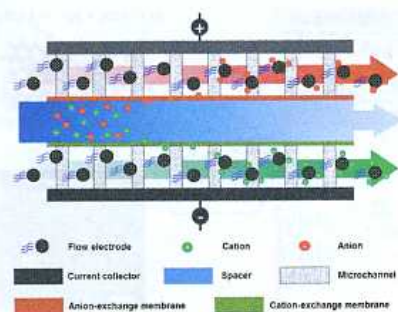
### Energy dispersive X-ray diffraction of lithium–silver vanadium phosphorous oxide cells: *in situ* cathode depth profiling of an electrochemical reduction–displacement reaction

Esther S. Takeuchi,\* Amy C. Marschlok,\* 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

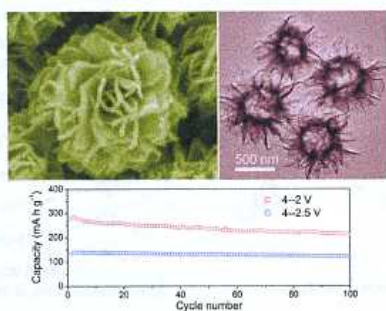


### Desalination via a new membrane capacitive deionization process utilizing flow-electrodes

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.

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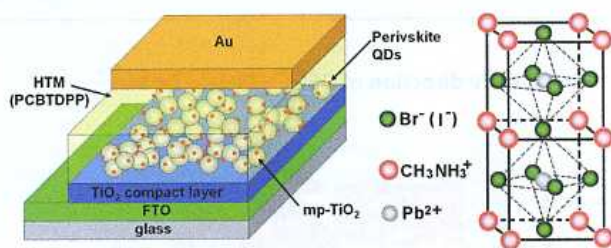


### Uniform $V_2O_5$ nanosheet-assembled hollow microflowers with excellent lithium storage properties

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

Hierarchical  $V_2O_5$  nanosheet-assembled hollow microflowers exhibit excellent lithium storage properties with high capacity and superior cycling stability.

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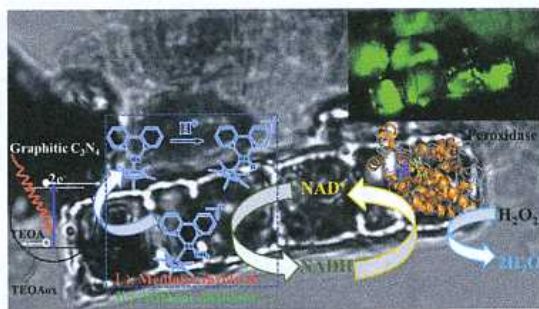


### High performance hybrid solar cells sensitized by organolead halide perovskites

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

Solid state solar cells with  $CH_3NH_3PbX_3$  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.

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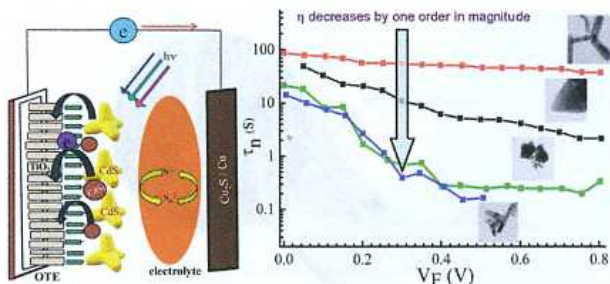
semicon

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.

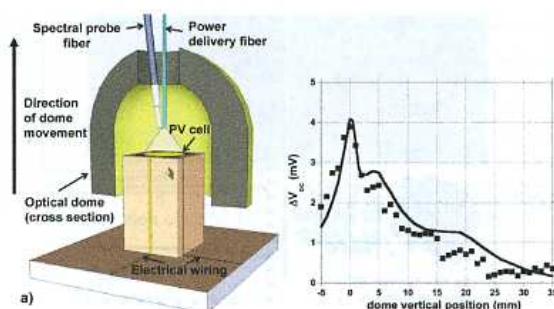


1499

### 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.

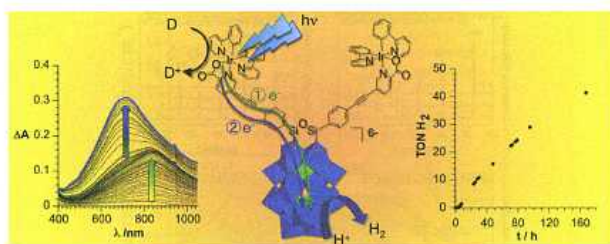


1504

### 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.

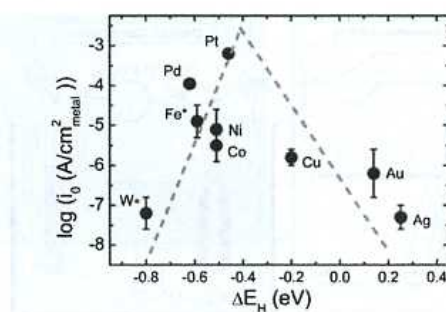


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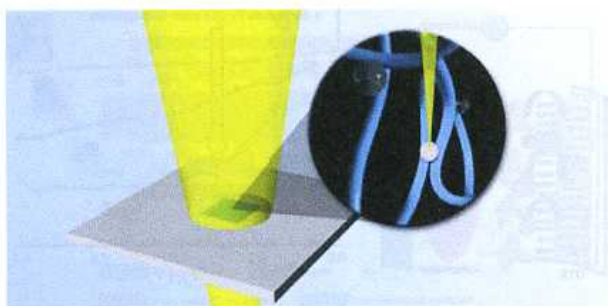
### Correlating the hydrogen evolution reaction activity in alkaline electrolytes with the hydrogen binding energy on monometallic surfaces

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

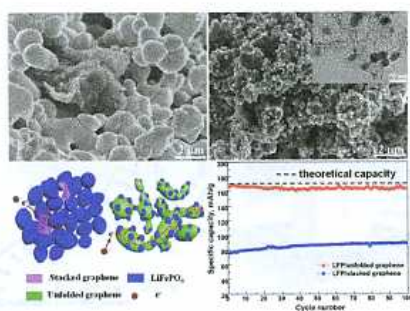


### Detection and role of trace impurities in high-performance organic solar cells

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

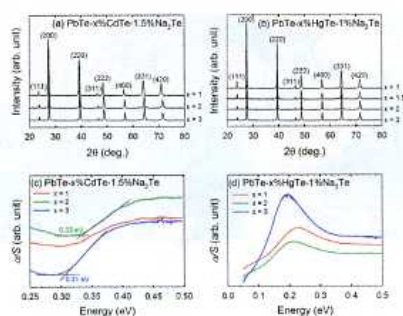


### LiFePO<sub>4</sub>-graphene as a superior cathode material for rechargeable lithium batteries: impact of stacked graphene and unfolded graphene

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

The LiFePO<sub>4</sub>-unfolded graphene nanocomposite achieved a discharge capacity of 166.2 mA h g<sup>-1</sup> in the 1st cycle, which is 98% of the theoretical capacity, whereas LiFePO<sub>4</sub>-stacked graphene only delivers a discharge capacity of 77 mA h g<sup>-1</sup>.

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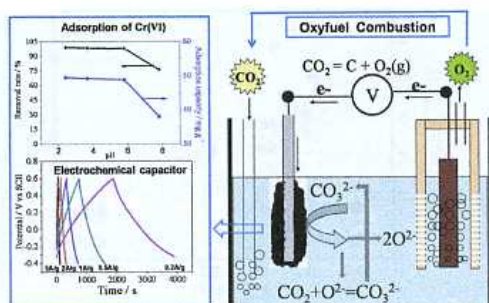


### Enhanced thermoelectric properties of p-type nanostructured PbTe-MTe (M = Cd, Hg) materials

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 Na<sub>2</sub>Te.

1538



### Capture and electrochemical conversion of CO<sub>2</sub> to value-added carbon and oxygen by molten salt electrolysis

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

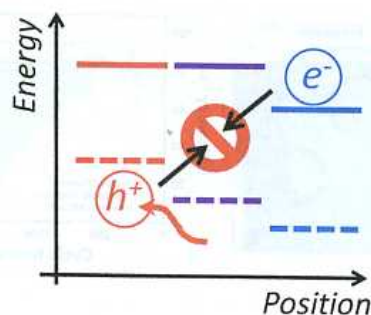
Effectively transforming CO<sub>2</sub> into value-added capacitive carbon and oxygen is demonstrated in a molten salt reactor armed with affordable electrodes.

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.

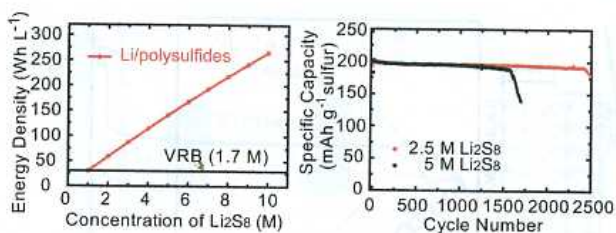


1552

### 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.

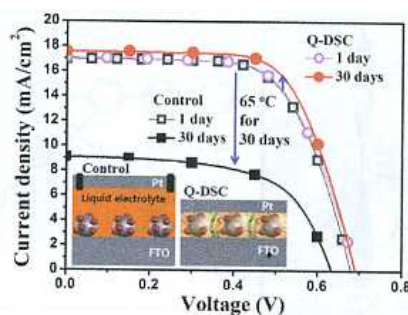


1559

### 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.



1565

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

Anna Loiudice, Aurora Rizzo,\* Giulia Grancini, Mariano Biasucci, 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.

