

## IN THIS ISSUE

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**Cover**  
See O'Hayre *et al.*,  
pp. 2957–2964.  
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**Inside cover**  
See Shen, Li, Fan *et al.*,  
pp. 2965–2971.  
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*Energy Environ. Sci.*, 2013, **6**, 2965.

## OPINION

2791

### Implanted biofuel cells operating *in vivo* – methods, applications and perspectives – feature article

Evgeny Katz\* and Kevin MacVittie

Biofuel cells implanted in living organisms and operating *in vivo* were considered as power sources for biomedical and sensor devices.



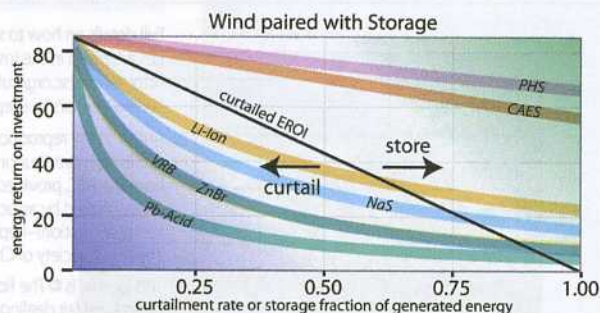
## ANALYSIS

2804

### The energetic implications of curtailing *versus* storing solar- and wind-generated electricity

Charles J. Barnhart,\* Michael Dale, Adam R. Brandt and Sally M. Benson

Should society store or curtail excess renewable generation?  
A net energy perspective.

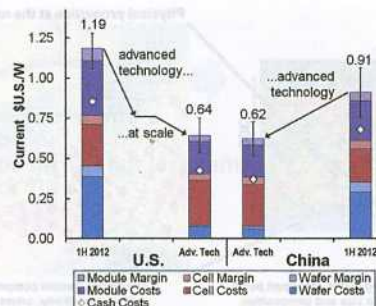


2811

### Assessing the drivers of regional trends in solar photovoltaic manufacturing

Alan C. Goodrich,\* Douglas M. Powell,\* Ted L. James, Michael Woodhouse and Tonio Buonassisi\*

Using a bottom-up cost analysis, we elucidate the drivers for historic regionalization trends in the solar photovoltaic (PV) industry. We conclude that the competitive advantage of leading production locations (e.g., China) is not inherent, but built. Consequently, we propose that technological innovations and scale may equalize manufacturing prices in the United States and China.



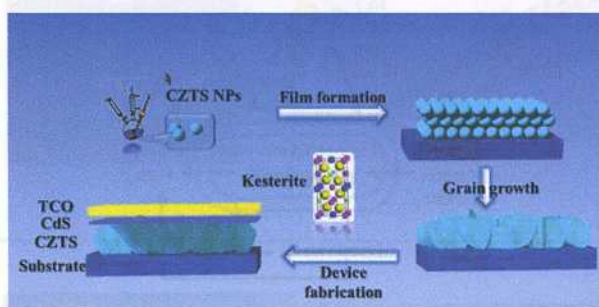
## REVIEWS

2822

### CZTS nanocrystals: a promising approach for next generation thin film photovoltaics

Huanping Zhou, Wan-Ching Hsu, Hsin-Sheng Duan, Brion Bob, Wenbing Yang, Tze-Bin Song, Chia-Jung Hsu and Yang Yang\*

$\text{Cu}_2\text{ZnSnS}_4$  nanocrystals represent a unique approach to realize low cost and high performance next generation solar cells.

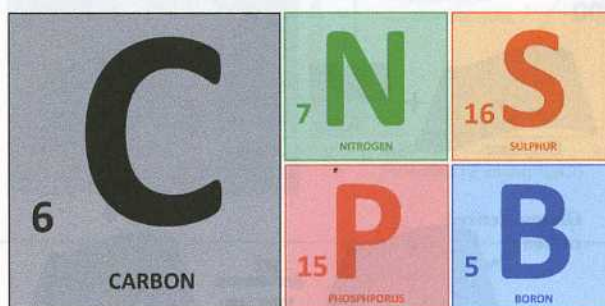


2839

### Doping carbons beyond nitrogen: an overview of advanced heteroatom doped carbons with boron, sulphur and phosphorus for energy applications

Jens Peter Paraknowitsch\* and Arne Thomas

In this review an overview of the most recent trends in carbon doping with heteroatoms for energy related applications is given – with a strong focus on dopants other than nitrogen.



## PERSPECTIVES

2856

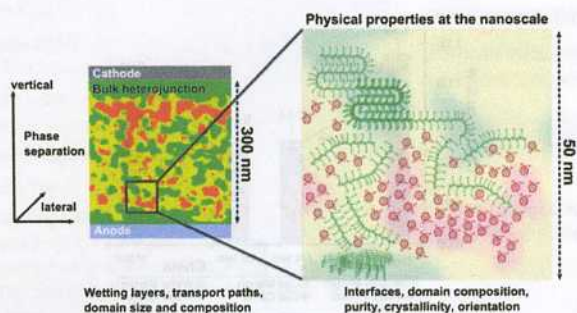
### 3D nanostructured conductive polymer hydrogels for high-performance electrochemical devices

Yu Zhao, Borui Liu, Lijia Pan\* and Guihua Yu\*

Recent promising achievements based on 3D nanostructured conductive polymer hydrogels for high-performance electrochemical devices.



2871



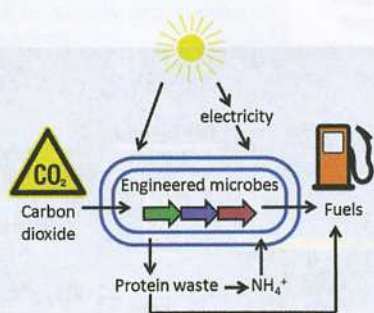
### Visualizing physical, electronic, and optical properties of organic photovoltaic cells

Martin Pfannmöller,\* Wolfgang Kowalsky and Rasmus R. Schröder\*

This review summarizes advances and explores future directions in multi-dimensional, functional imaging of nanoscale physical properties of organic photovoltaic blends.

## MINIREVIEW

2892



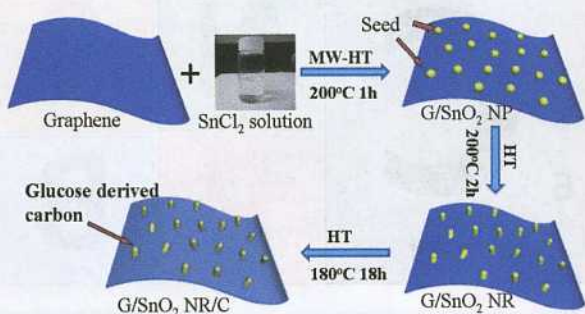
### Biological conversion of carbon dioxide to photosynthetic fuels and electrofuels

Han Li and James C. Liao\*

CO<sub>2</sub> can be directly converted to fuels by autotrophic microorganisms, which can use sunlight directly or sunlight-derived electricity as the energy source.

## COMMUNICATIONS

2900

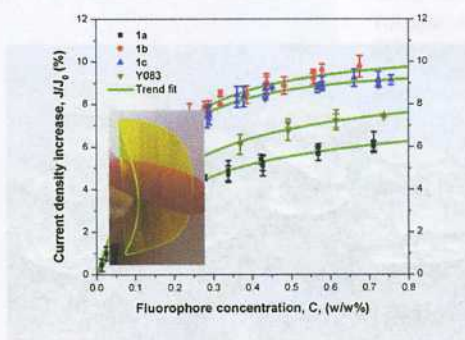


### Layer by layer assembly of sandwiched graphene/SnO<sub>2</sub> nanorod/carbon nanostructures with ultrahigh lithium ion storage properties

Dongniu Wang, Jinli Yang, Xifei Li, Dongsheng Geng, Ruying Li, Mei Cai, Tsun-Kong Sham\* and Xueliang Sun\*

Carbon coated SnO<sub>2</sub> nanorods rooted on graphene nanocomposites exhibit an ultrahigh capacity (1419 mA h g<sup>-1</sup>) benefiting from structural features.

2907



### Increasing the power output of a CdTe solar cell via luminescent down shifting molecules with intramolecular charge transfer and aggregation-induced emission characteristics

Yilin Li, Zhipeng Li, Yang Wang, Alvin Compaan, Tianhui Ren\* and Wen-Ji Dong\*

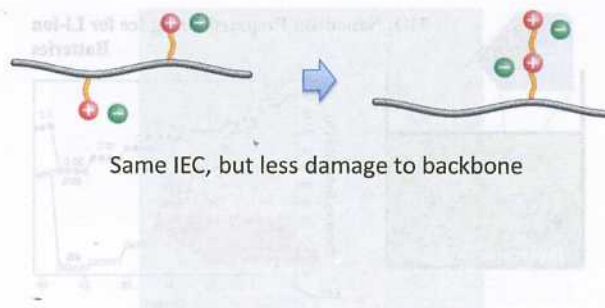
The output power of a CdTe solar cell was increased by the luminescent down-shifting materials.

2912

### A strategy for disentangling the conductivity–stability dilemma in alkaline polymer electrolytes

Jing Pan, Yao Li, Juanjuan Han, Guangwei Li, Lisheng Tan, Chen Chen, Juntao Lu and Lin Zhuang\*

A strategy to simultaneously obtain high ionic conductivity and high chemical stability of alkaline polymer electrolytes has been proposed.

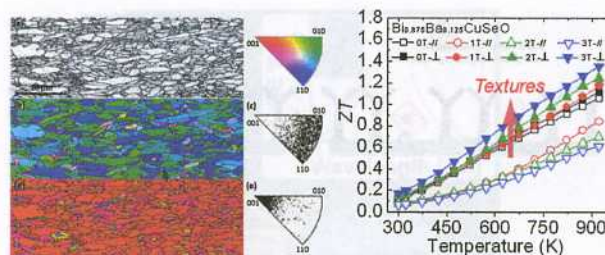


2916

### Texturation boosts the thermoelectric performance of BiCuSeO oxyselenides

Jiehe Sui, Jing Li, Jiaqing He,\* Yan-Ling Pei, David Berardan, Haijun Wu, Nita Dragoe, Wei Cai and Li-Dong Zhao\*

A high  $ZT$  of  $\sim 1.4$  at 923 K for  $\text{Bi}_{0.875}\text{Ba}_{0.125}\text{CuSeO}$  has been achieved by textured processing through improving the carrier mobility.

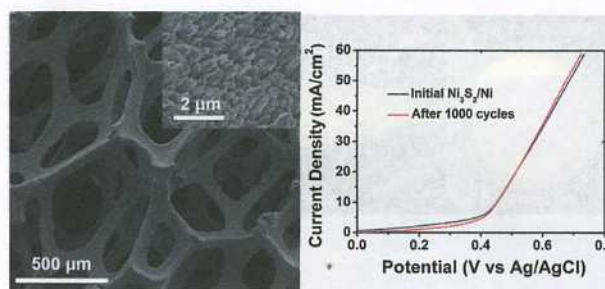


2921

### $\text{Ni}_3\text{S}_2$ nanorods/Ni foam composite electrode with low overpotential for electrocatalytic oxygen evolution

Weijia Zhou, Xue-Jun Wu, Xiehong Cao, Xiao Huang, Chaoliang Tan, Jian Tian, Hong Liu,\* Jiyang Wang and Hua Zhang\*

$\text{Ni}_3\text{S}_2$  nanorods/Ni foam composite electrode exhibits excellent oxygen evolution reaction activity with a small onset overpotential of  $\sim 157$  mV.

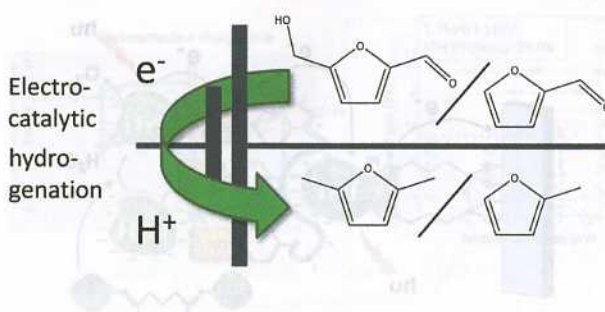


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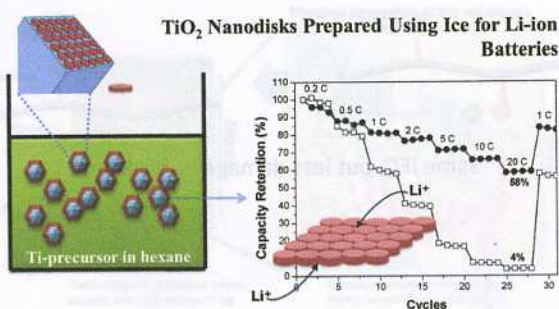
### Electrochemistry for biofuel generation: production of furans by electrocatalytic hydrogenation of furfurals

Peter Nilges and Uwe Schröder\*

The efficient room temperature electrochemical hydrogenation of furfural and 5-HMF to methylfuran and dimethylfuran, respectively, is demonstrated.



2932

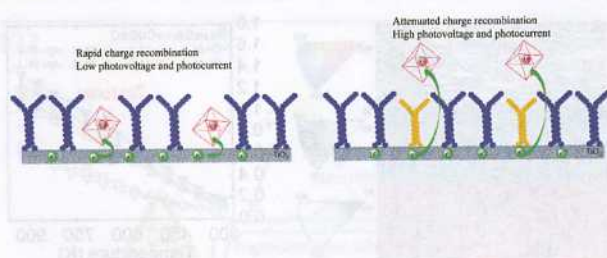


### TiO<sub>2</sub> nanodisks designed for Li-ion batteries: a novel strategy for obtaining an ultrathin and high surface area anode material at the ice interface

Gonu Kim, Changshin Jo, Wooyul Kim, Jinyoung Chun, Songhun Yoon, Jinwoo Lee\* and Wonyong Choi\*

A rapid and relatively large-scale production of ultrathin TiO<sub>2</sub> nanodisks designed for Li-ion batteries was achieved through a novel and simple sol-gel process occurring at the interface of an organic solvent and ice.

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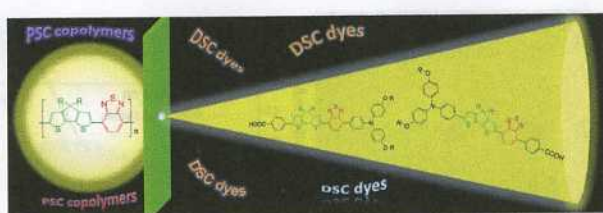


### Judicious selection of a pinhole defect filler to generally enhance the performance of organic dye-sensitized solar cells

Min Zhang, Jing Zhang, Ye Fan, Lin Yang, Yinglin Wang, Renzhi Li and Peng Wang\*

We demonstrate a general strategy of pinhole defect filling to enhance the performance of organic dye-sensitized solar cells.

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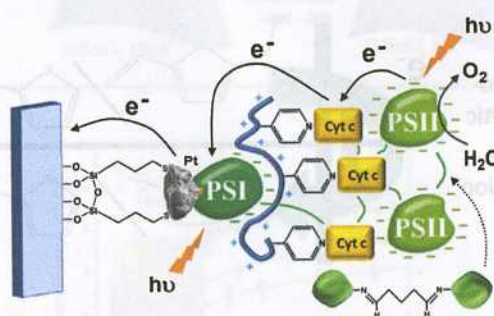


### Design of high-efficiency organic dyes for titania solar cells based on the chromophoric core of cyclopentadithiophene-benzothiadiazole

Min Zhang, Yinglin Wang, Mingfei Xu, Wentao Ma, Renzhi Li and Peng Wang\*

We have elaborately tailored organic dyes displaying power conversion efficiencies at the simulated air mass 1.5 full sunlight of over 11%.

2950



### Cytochrome c-coupled photosystem I and photosystem II (PSI/PSII) photo-bioelectrochemical cells

Ariel Efrati, Ran Tel-Vered, Dorit Michaeli, Rachel Nechushtai and Itamar Willner\*

A cytochrome c-electrically wired photosystem I / photosystem II assembly mimics the natural Z-scheme and acts as a photo-bioelectrochemical electrode.

