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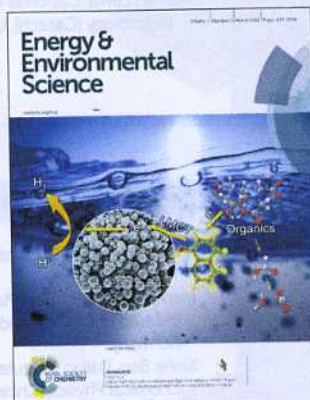
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IN THIS ISSUE

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Cover
See Mitzi *et al.*,
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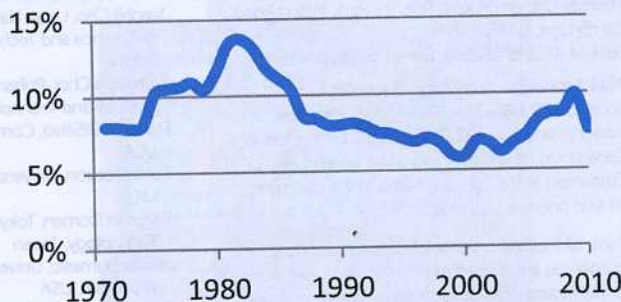
OPINION

846

Solar energy: setting the economic bar from the top-down

E. W. McFarland

Sunlight is thermal radiation from sustained nuclear reactions within our sun. Our challenge is to harness this solar energy at a cost less than 10% of our GDP.



ANALYSIS

855

Large scale deployment of polymer solar cells on land, on sea and in the air

Nieves Espinosa, Markus Hösel, Mikkel Jørgensen and Frederik C. Krebs*

With the development of patterns that connect all cells in series, organic photovoltaics have leapt a step forward being ahead of other solar and even other energy technologies in terms of manufacturing speed, installation speed, ease of deployment and energy pay-back time.

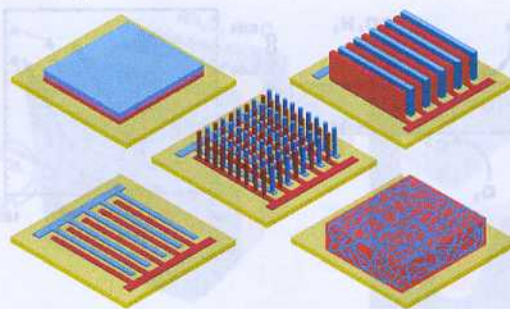


867

Capacitive energy storage in micro-scale devices: recent advances in design and fabrication of micro-supercapacitors

Majid Beidaghi and Yury Gogotsi*

The growing field of micro-supercapacitors is reviewed in this article with a focus on electrode materials and device fabrication methods. The most promising advances and future challenges are identified.

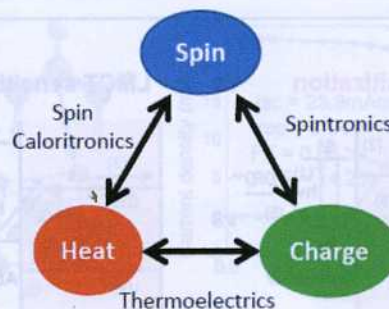


885

Spin caloritronics

Stephen R. Boona, Roberto C. Myers and Joseph P. Heremans*

Spin caloritronics explores the relationship between spin and heat transport in materials. This review provides an in-depth discussion of the physical origins of these transport effects, along with a detailed description of several recent developments in this field, and an overview of some proposed thermal energy conversion applications inspired by these recent discoveries.



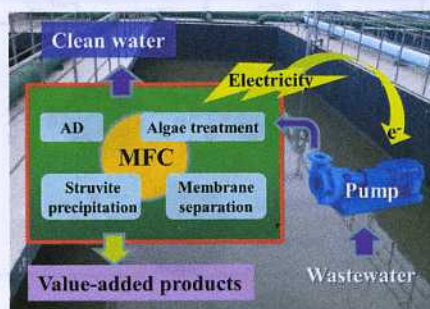
PERSPECTIVES

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Towards sustainable wastewater treatment by using microbial fuel cells-centered technologies

Wen-Wei Li, Han-Qing Yu* and Zhen He*

Microbial fuel cells (MFCs) have been conceived and intensively studied as a promising technology to achieve sustainable wastewater treatment.

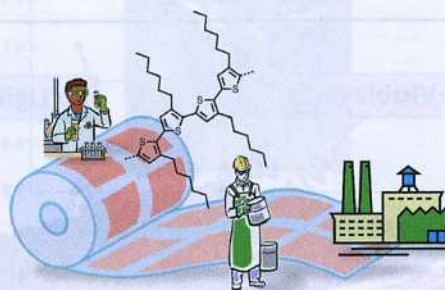


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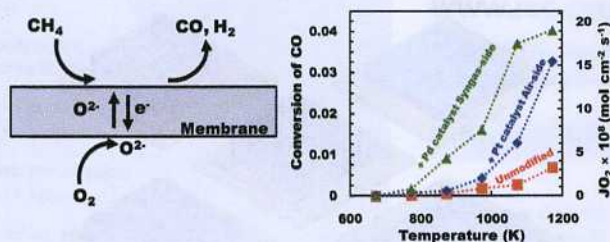
From lab to fab: how must the polymer solar cell materials design change? – an industrial perspective

Riccardo Po,* Andrea Bernardi, Anna Calabrese, Chiara Carbonera, Gianni Corso and Andrea Pellegrino

The design of materials for efficient large-area printed polymer solar modules beyond the lab-scale research is discussed.



944



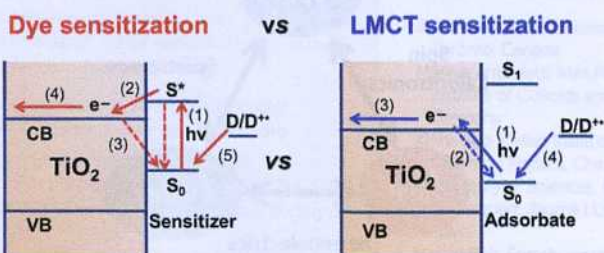
Interfacial reactions in ceramic membrane reactors for syngas production

A. S. Yu, J. M. Vohs and R. J. Gorte*

Limitations due to surface reactions in ceramic membrane reactors for syngas production are discussed using insights from solid oxide fuel cell research.

MINIREVIEW

954



Alternative way of solar activation of titania

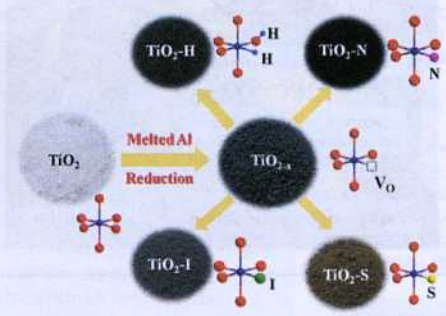
Visible light driven photocatalysis mediated via ligand-to-metal charge transfer (LMCT): an alternative approach to solar activation of titania

Guan Zhang, Gonu Kim and Wonyong Choi*

In this mini-review we summarize the recent advances in the ligand-to-metal charge transfer (LMCT) mediated visible light photocatalysis on TiO₂ for environmental and energy applications.

COMMUNICATIONS

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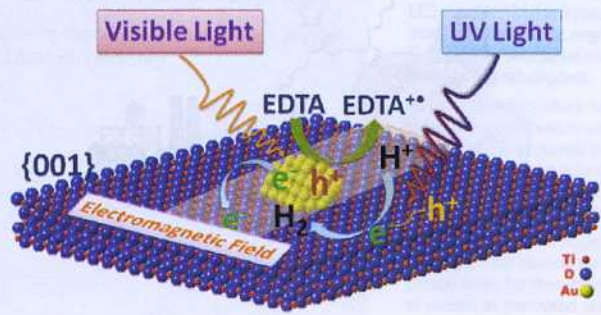


Effective nonmetal incorporation in black titania with enhanced solar energy utilization

Tianquan Lin, Chongyin Yang, Zhou Wang, Hao Yin, Xujie Lü, Fuqiang Huang,* Jianhua Lin, Xiaoming Xie and Mianheng Jiang

Heavy nonmetal-doped black titania with a unique crystalline core/amorphous shell structure is achieved to boost visible-light photocatalysis.

973



Gold-plasmon enhanced solar-to-hydrogen conversion on the {001} facets of anatase TiO₂ nanosheets

Jinlin Long,* Hongjin Chang, Quan Gu, Jie Xu, Lizhou Fan, Shuchao Wang, Yangen Zhou, Wei Wei, Ling Huang,* Xuxu Wang, Ping Liu and Wei Huang*

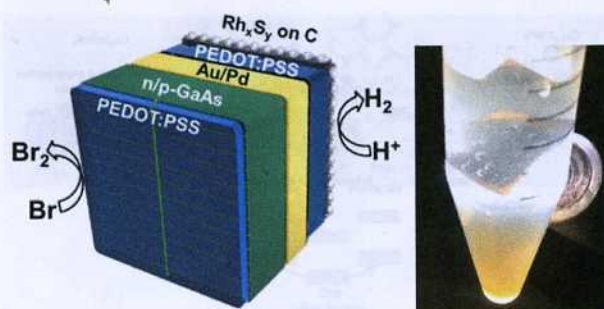
A 64-fold improved efficiency of solar-to-hydrogen conversion was achieved via exposing Au nanoparticles on the {001} facets of anatase TiO₂ nanosheets.

978

Stable electrocatalysts for autonomous photoelectrolysis of hydrobromic acid using single-junction solar cells

N. Singh, S. Mubeen, J. Lee, H. Metiu, M. Moskovits and E. W. McFarland*

Here we demonstrate the use of a metal sulfide catalyst to extend the lifetime of a photoelectrochemical cell for electrolysis of HBr using only sunlight.

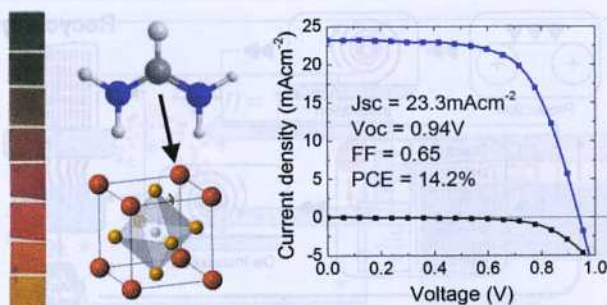


982

Formamidinium lead trihalide: a broadly tunable perovskite for efficient planar heterojunction solar cells

Giles E. Eperon, Samuel D. Stranks, Christopher Menelaou, Michael B. Johnston, Laura M. Herz and Henry J. Snaith*

A new perovskite, formamidinium lead trihalide, shows bandgap tunability between 2.23 eV and 1.48 eV. When incorporated into planar heterojunction perovskite solar cells, it is able to generate high short-circuit currents of $>23 \text{ mA cm}^{-2}$, resulting in efficiencies of up to 14.2%.

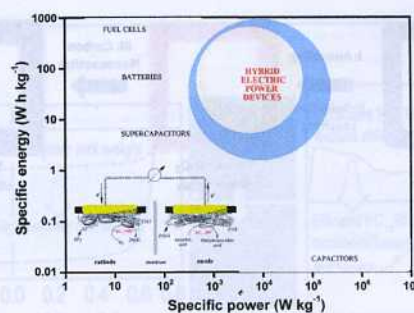


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A hybrid electric power device for simultaneous generation and storage of electric energy

Dmitry Pankratov, Peter Falkman, Zoltan Blum and Sergey Shleev*

Hybrid electric power devices, simultaneously generating electric power and capacitively storing electric energy within a singular contrivance, were fabricated.

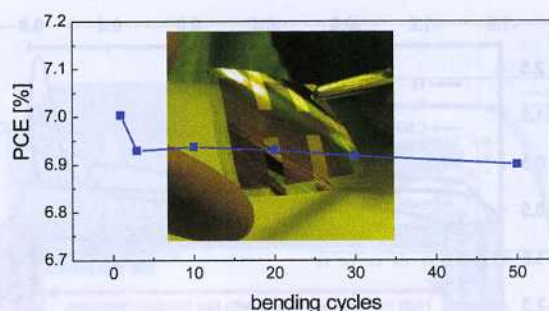


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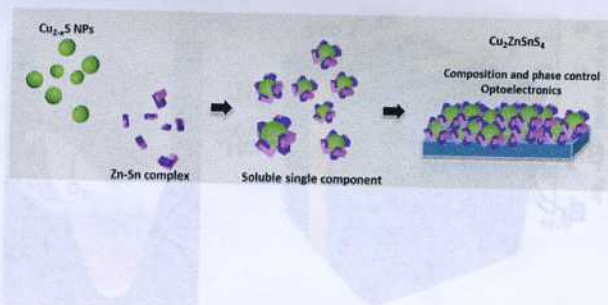
Flexible high efficiency perovskite solar cells

Cristina Roldán-Carmona, Olga Malinkiewicz, Alejandra Soriano, Guillermo Mínguez Espallargas, Ana Garcia, Patrick Reinecke, Thomas Kroyer, M. Ibrahim Dar, Mohammad Khaja Nazeeruddin and Henk J. Bolink*

High efficiency flexible methylammonium lead iodide perovskite based solar cells are compatible with roll to roll processing.



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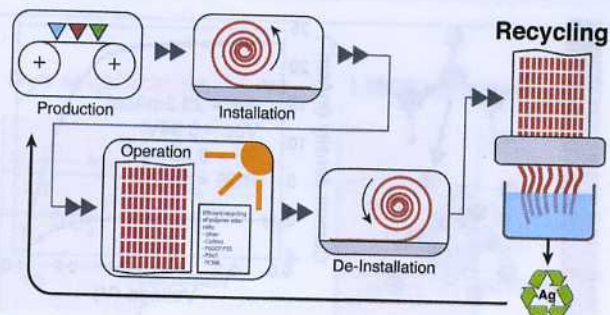


Facile single-component precursor for $\text{Cu}_2\text{ZnSnS}_4$ with enhanced phase and composition controllability

Huanping Zhou, Hsin-Sheng Duan, Wenbing Yang, Qi Chen, Chia-Jung Hsu, Wan-Ching Hsu, Chun-Chao Chen and Yang Yang*

We report a facile, quantitative and clean fabrication of kesterite $\text{Cu}_2\text{ZnSnS}_4$ film from a single-component precursor, crystalline Cu_{2-x}S capped with multi-metal chalcogenide ligands, Zn-Sn complex, and demonstrate its optoelectronic performance.

1006

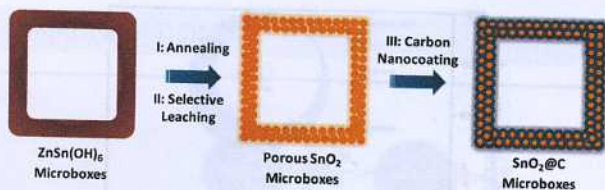


Efficient decommissioning and recycling of polymer solar cells: justification for use of silver

Roar R. Søndergaard, Nieves Espinosa, Mikkel Jørgensen and Frederik C. Krebs*

The use of silver in fully printed polymer solar cells is justified through efficient recovery and recycling.

1013

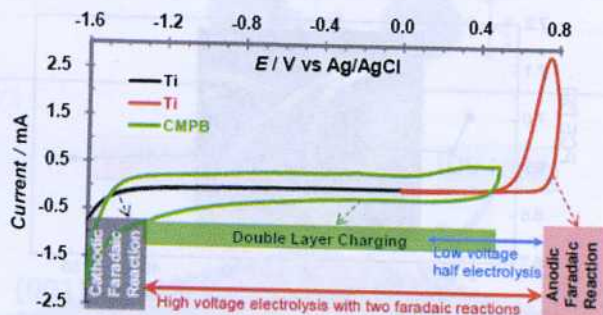


Formation of porous SnO_2 microboxes via selective leaching for highly reversible lithium storage

Lei Zhang, Hao Bin Wu, Bin Liu* and Xiong Wen (David) Lou*

Porous carbon-coated SnO_2 microboxes with high uniformity are prepared via a novel selective leaching strategy, and exhibit excellent electrochemical performance as anode materials for lithium-ion batteries.

1018



Achieving low voltage half electrolysis with a supercapacitor electrode

Chuang Peng,* Di Hu and George Z. Chen*

Half electrolysis consists of one faradaic reaction and a supercapacitor double layer charging process. In such a configuration, the product of the electrolysis is only generated in the vicinity of one electrode. Furthermore the electrolysis voltage and electric energy consumption are significantly reduced.

