

Energy & Environmental Science

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IN THIS ISSUE

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Cover

See Bettina V. Lotsch *et al.*, pp. 2578–2585.
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Inside cover

See Yury Gogotsi *et al.*, pp. 2586–2594.
Image reproduced by permission of Yury Gogotsi from *Energy Environ. Sci.*, 2016, 9, 2586.

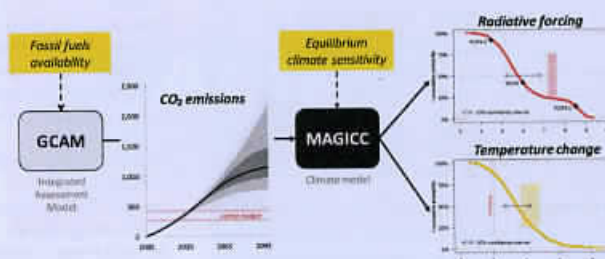
ANALYSIS

2482

Likelihood of climate change pathways under uncertainty on fossil fuel resource availability

Iñigo Capellán-Pérez,* Iñaki Arto, Josué M. Polanco-Martínez, Mikel González-Eguino and Marc B. Neumann

The consideration of the entire range of revised estimates of fossil fuels resources shows that their depletion is likely to occur during the 21st century accelerating the transition to renewable energy sources but not alleviating the need for urgent climate action.

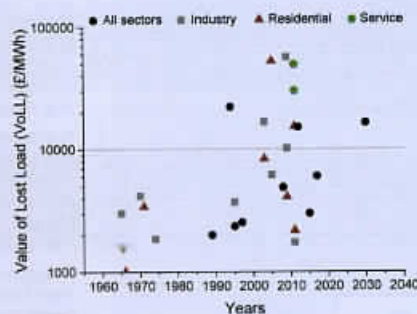


2497

Quantifying the value of CCS for the future electricity system

Clara F. Heuberger, Iain Staffell, Nilay Shah and Niall Mac Dowell*

Many studies have quantified the cost of Carbon Capture and Storage (CCS) power plants, but relatively few discuss or appreciate the unique value this technology provides to the electricity system.

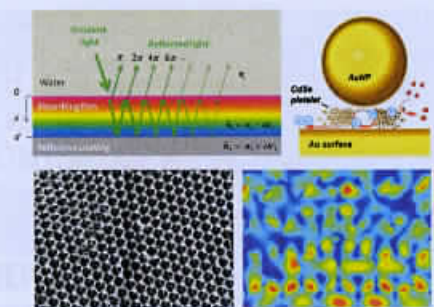


2511

Photonic nanostructures for solar energy conversion

Xiuzhen Zheng and Liwu Zhang*

This review article provides a comprehensive review of recent progress in photonic nanostructures for efficient solar energy conversion.



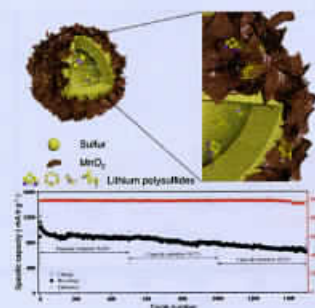
COMMUNICATIONS

2533

Structural and chemical synergistic encapsulation of polysulfides enables ultralong-life lithium-sulfur batteries

Xiaolei Wang, Ge Li, Jingde Li, Yining Zhang, Ahn Wook, Aiping Yu and Zhongwei Chen*

An innovative design strategy for the structural and chemical synergistic encapsulation of polysulfides is proposed enabling the achievement of ultra stable lithium-sulfur batteries.



2539

The microbial electrochemical Peltier heat: an energetic burden and engineering chance for primary microbial electrochemical technologies

Benjamin Korth, Thomas Maskow, Cristian Picioareanu and Falk Harnisch*

Microbes shoveling electrons heat up: combining calorimetry with microbial electrochemistry allows deciphering heat fluxes of electroactive microorganisms.

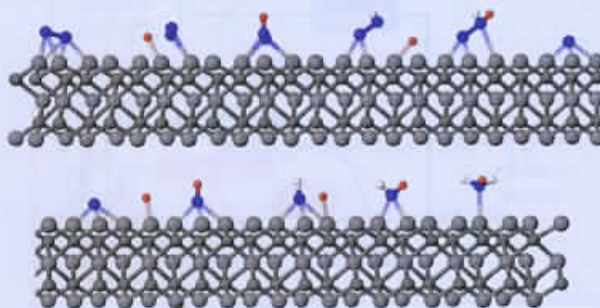


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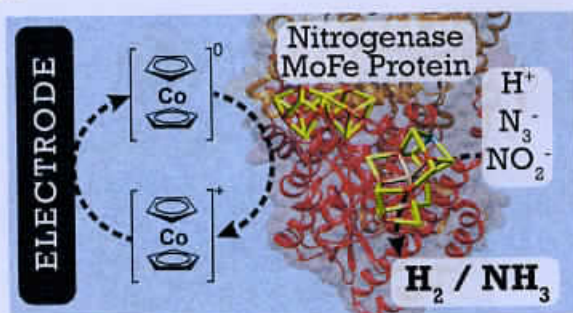
Promising prospects for 2D d^2-d^4 M_3C_2 transition metal carbides (MXenes) in N_2 capture and conversion into ammonia

Luis Miguel Azofra, Neng Li, Douglas R. MacFarlane and Chenghua Sun*

MXenes: potential catalysts for the electrochemical synthesis of ammonia.



2550

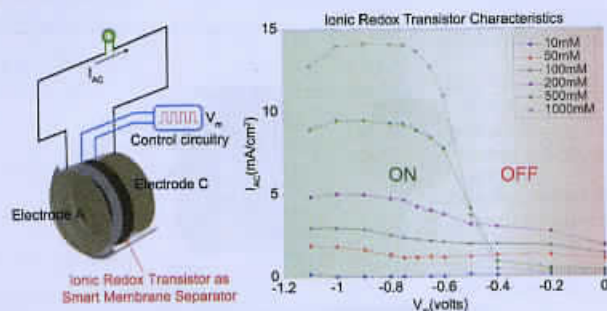


Nitrogenase bioelectrocatalysis: heterogeneous ammonia and hydrogen production by MoFe protein

Ross D. Milton, Sofiene Abdellaoui, Nimesh Khadka, Dennis R. Dean, Dónal Leech, Lance C. Seefeldt and Shelley D. Minteer*

Nitrogenase MoFe protein immobilization yields a bioelectrode capable of producing H_2 and NH_3 independent of the ATP-hydrolyzing Fe protein.

2555

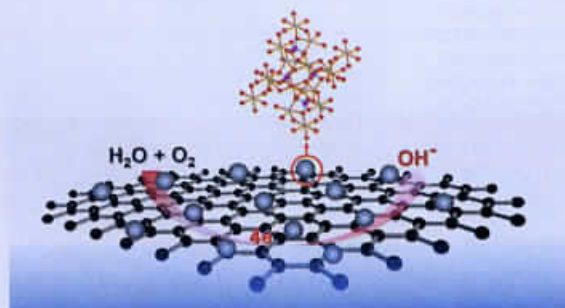


Ionic redox transistor from pore-spanning PPy(DBS) membranes

Travis Hery and Vishnu-Baba Sundaresan*

We demonstrate controlled ion transport through PPy(DBS) membranes formed on porous substrates by varying its electrochemical oxidation state, and its application as a smart membrane separator in energy storage devices.

2563

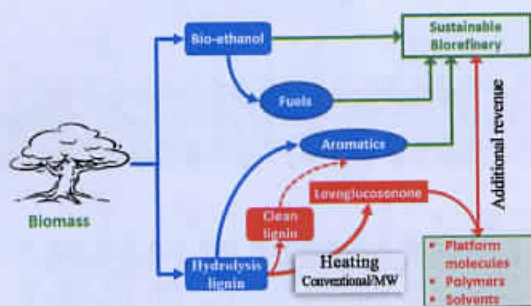


Nitrogen-doped cobalt phosphate@nanocarbon hybrids for efficient electrocatalytic oxygen reduction

Tianhua Zhou, Yonghua Du, Shengming Yin, Xuezheng Tian, Hongbin Yang, Xin Wang, Bin Liu, Haimei Zheng, Shizhang Qiao* and Rong Xu*

A nitrogen-doped $Co_3(PO_4)_2@nanocarbon$ hybrid was developed as an oxygen reduction reaction (ORR) catalyst and exhibits outstanding catalytic performance with high activity, long-term stability and a four-electron transfer pathway.

2571



A new perspective in bio-refining: levoglucosenone and cleaner lignin from waste biorefinery hydrolysis lignin by selective conversion of residual saccharides

M. De bruyn, J. Fan, V. L. Budarin, D. J. Macquarrie, L. D. Gomez, R. Simister, T. J. Farmer, W. D. Raverty, S. J. McQueen-Mason and J. H. Clark*

The sustainability of biorefineries can be improved through levoglucosenone production from residual sugars in waste lignin.

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Exploring

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PAPERS

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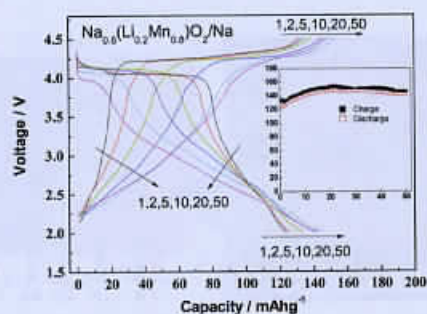
This jourm

2575

Exploring reversible oxidation of oxygen in a manganese oxide

Ke Du, Jinyou Zhu, Guorong Hu, Hongcai Gao, Yutao Li and John B. Goodenough*

Oxidation of layered P3- $\text{Na}_{0.6}(\text{Li}_{0.2}\text{Mn}_{0.8})\text{O}_2$ by electrochemical removal of Na^+ introduces holes into the O-2p bands at 4.2 V, but the voltage plateau fades on cycling.



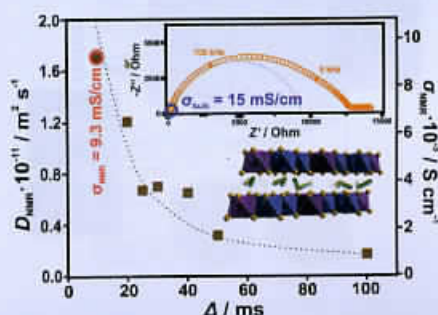
PAPERS

2578

$\text{Li}_{0.6}[\text{Li}_{0.2}\text{Sn}_{0.8}\text{S}_2]$ – a layered lithium superionic conductor

T. Holzmann, L. M. Schoop, M. N. Ali, I. Moudrakovski, G. Gregori, J. Maier, R. J. Cava and B. V. Lotsch*

Implementing vacant sites enhances the Li mobility in lithium tin sulfide enormously as demonstrated by the increase in Li conductivity from $10^{-5} \text{ S cm}^{-1}$ in $\text{Li}_{1.0}[\text{Li}_{0.33}\text{Sn}_{0.67}\text{S}_2]$ to $10^{-2} \text{ S cm}^{-1}$ in $\text{Li}_{0.6}[\text{Li}_{0.2}\text{Sn}_{0.8}\text{S}_2]$.

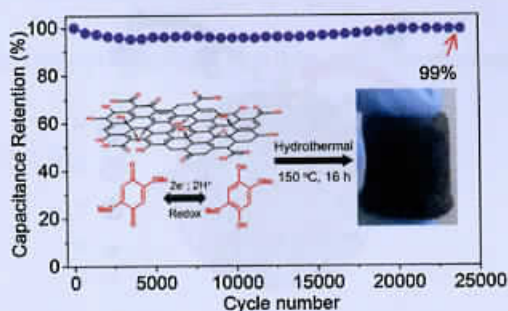


2586

Pseudocapacitance and excellent cyclability of 2,5-dimethoxy-1,4-benzoquinone on graphene

Muhammad Boota, Chi Chen, Matthieu Bécuwe, Ling Miao and Yury Gogotsi*

Non-covalent functionalization of 2,5-dimethoxy-1,4-benzoquinone and hydroquinone on reduced graphene oxide sheets led to the formation of a redox-active three-dimensional gel architecture via a one-step hydrothermal method, where the former exhibited high gravimetric and volumetric capacitance and 99% capacitance retention after 25 000 cycles at 50 mV s^{-1} .

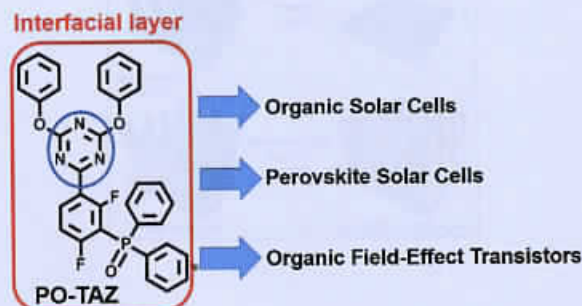


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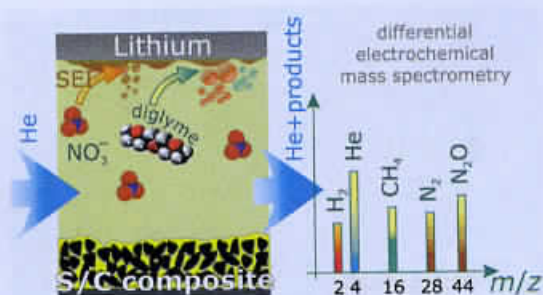
A simple structured and efficient triazine-based molecule as an interfacial layer for high performance organic electronics

Nallan Chakravarthi, Kumarasamy Gunasekar, Woosum Cho, Dang Xuan Long, Yun-Hi Kim, Chang Eun Song, Jong-Cheol Lee, Antonio Facchetti, Myungkwan Song,* Yong-Young Noh* and Sung-Ho Jin*

The highly efficient organic electronic devices achieved by PO-TAZ as an interfacial layer.



2603

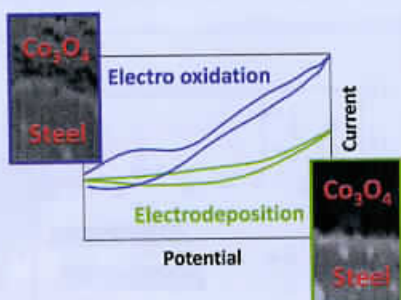


The critical role of lithium nitrate in the gas evolution of lithium–sulfur batteries

Anna Jozwiuk,* Balázs B. Berkes,* Thomas Weiß, Heino Sommer, Jürgen Janek and Torsten Brezesinski*

The polysulfide shuttle suppressing additive LiNO_3 significantly reduces, but does not completely eliminate gassing in lithium–sulfur batteries.

2609

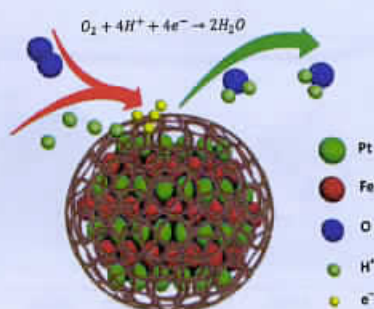


$\text{X}20\text{CoCrWMo}10-9//\text{Co}_3\text{O}_4$: a metal–ceramic composite with unique efficiency values for water-splitting in the neutral regime

Helmut Schäfer,* Daniel M. Chevrier, Karsten Kuepper, Peng Zhang, Joachim Wollschlaeger, Diemo Daum, Martin Steinhart, Claudia Heß, Ulrich Krupp, Klaus Müller-Buschbaum, Johannes Stangl and Mercedes Schmidt

The intrinsic, “from within itself” formation of Co_3O_4 on a hot work tool steel resulted in an outstanding electrocatalyst.

2623

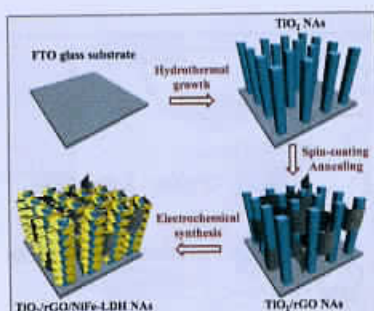


Fine-grained and fully ordered intermetallic PtFe catalysts with largely enhanced catalytic activity and durability

Xin Xin Du, Yang He, Xiao Xia Wang and Jian Nong Wang*

Structurally ordered intermetallic particles encapsulated in carbon layers exhibit excellent catalytic activity and durability toward oxygen reduction reaction.

2633



TiO_2 /graphene/NiFe-layered double hydroxide nanorod array photoanodes for efficient photoelectrochemical water splitting

Fanyu Ning, Mingfei Shao,* Simin Xu, Yi Fu, Ruikang Zhang, Min Wei,* David G. Evans and Xue Duan

TiO_2 /graphene/NiFe-layered double hydroxide nanorod arrays were fabricated as highly efficient photoanodes for photoelectrochemical water splitting with simultaneously enhanced charge separation and water oxidation efficiency.

2644

Energy-yield tandem solar cells

Jonathan F. Stoddart, Tonio Buonassisi

Polycrystalline commercial silicon solar cells could overcome the limits of single-junction energy-yield and tandem solar cells.

2654

Thermophotovoltaic efficiency

Hamid Reza Ghazvini, Thermophotovoltaic solar power

CORRECTION

2666

Corrected lithium ion

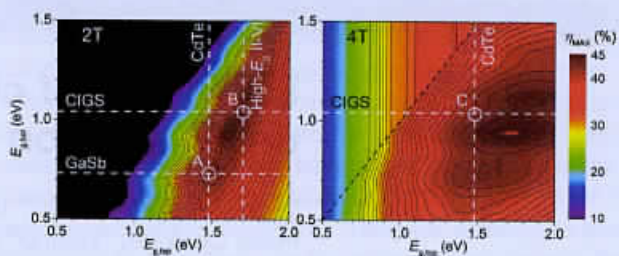
Debin Kong and Linjie

2644

Energy-yield prediction for II–VI-based thin-film tandem solar cells

Jonathan P. Mailoa,* Mitchell Lee, Ian M. Peters, Tonio Buonassisi, Alex Panchula and Dirk N. Weiss*

Polycrystalline, thin-film tandem solar cells that leverage commercial II–VI semiconductor technologies as the top cell could overcome the practical conversion-efficiency limits of single-junction solar cells. In this paper we provide energy-yield calculation of a solar cell – single-junction and tandem – in a real-world climate conditions.

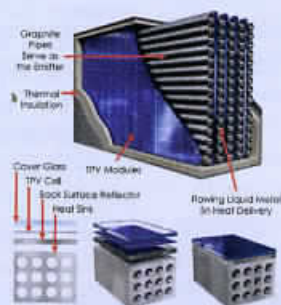


2654

Thermophotovoltaics: a potential pathway to high efficiency concentrated solar power

Hamid Reza Seyf* and Asegun Henry

Thermophotovoltaics power block for concentrated solar power.



CORRECTION

2666

Correction: Encapsulating V_2O_5 into carbon nanotubes enables the synthesis of flexible high-performance lithium ion batteries

Debin Kong, Xianglong Li, Yunbo Zhang, Xiao Hai, Bin Wang, Xiongying Qiu, Qi Song, Quan-Hong Yang* and Linjie Zhi*