

## IN THIS ISSUE

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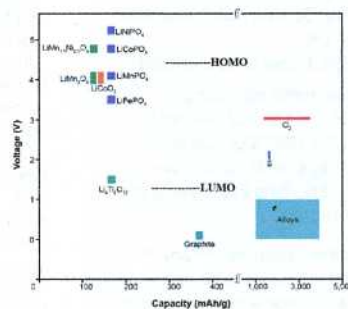
## OPINIONS

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### Electrochemical energy storage in a sustainable modern society

John B. Goodenough\*

Oxide/polymer separator membranes allow alternative strategies for Li-ion and Na-ion batteries storing electrical energy for the grid.



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### Reflections on the topic of solar fuels

John Meurig Thomas

For reasons outlined in this article, those who travel on the highly important road towards solar fuels have quite a long way to go before they reach the promised land.

### Products from petroleum

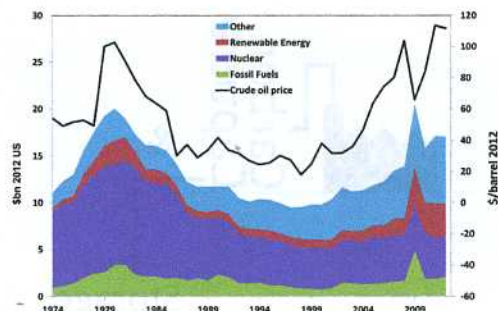
<ul style="list-style-type: none"> <li>Teas</li> <li>Crayons</li> <li>Parachutes</li> <li>Telephones</li> <li>Eraser</li> <li>Planes</li> <li>Dishes</li> <li>Cameras</li> <li>Aerobics</li> <li>Artificial Turf</li> <li>Artificial Imbs</li> <li>Bandages</li> <li>Dentures</li> <li>Muscle Cars</li> <li>Folding Doors</li> <li>Hair Cutters</li> <li>Cold cream</li> <li>Movie Film</li> <li>Ski Contact Inners</li> <li>Drinking Cups</li> <li>Fan Belts</li> <li>Car Exhaust</li> <li>Shaving Cream</li> <li>Antiseptic</li> <li>Refrigerators</li> <li>Golf Balls</li> <li>Toothpaste</li> <li>Gasoline</li> </ul>	<ul style="list-style-type: none"> <li>Heart Valves</li> <li>Candles</li> <li>Trash Bags</li> <li>House Paint</li> <li>Water Pipes</li> <li>Hand Loom</li> <li>Roller Skates</li> <li>Golf Balls</li> <li>Shampoo</li> <li>Wheels</li> <li>Fair Follies</li> <li>Shower Curtains</li> <li>Guitar Strings</li> <li>Luggage</li> <li>Aspirin</li> <li>Paints</li> <li>Shower Curtains</li> <li>Guitar Strings</li> <li>Luggage</li> <li>Aspirin</li> <li>Safety Glasses</li> <li>Antiseptic</li> <li>Football Helmets</li> <li>Airbags</li> <li>Pyrethrin</li> <li>Clothes</li> <li>Toothbrushes</li> <li>Ice Chests</li> <li>Football</li> <li>Curtains</li> <li>CD's &amp; DVD's</li> <li>Fair Biscuits</li> <li>Deodorant</li> </ul>	<ul style="list-style-type: none"> <li>Perfumes</li> <li>TV Cabinets</li> <li>Shag Rugs</li> <li>Electrician's Tape</li> <li>Toilet Brushes</li> <li>Car Battery Cases</li> <li>Eraser</li> <li>Plank</li> <li>Mop</li> <li>Wheels</li> <li>Fair Follies</li> <li>Shower Curtains</li> <li>Guitar Strings</li> <li>Luggage</li> <li>Aspirin</li> <li>Safety Glasses</li> <li>Antiseptic</li> <li>Football Helmets</li> <li>Airbags</li> <li>Pyrethrin</li> <li>Clothes</li> <li>Toothbrushes</li> <li>Ice Chests</li> <li>Football</li> <li>Curtains</li> <li>CD's &amp; DVD's</li> <li>Fair Biscuits</li> <li>Deodorant</li> </ul>	<ul style="list-style-type: none"> <li>Castor Oil</li> <li>Oilwasher parts</li> <li>Tool Boxes</li> <li>Shoe Polish</li> <li>Motorcycle Helmet</li> <li>Caution</li> <li>Parachute Jolly</li> <li>Transparent Tape</li> <li>CD Player</li> <li>Faucet Washers</li> <li>Antiseptic</li> <li>Chisel</li> <li>Curtains</li> <li>Food Preservatives</li> <li>Basketballs</li> <li>Soap</li> <li>Vitamin Capsules</li> <li>Acetic Acid</li> <li>Fluores</li> <li>Shoes</li> <li>Darkboards</li> <li>Carbon</li> <li>Deodorant</li> <li>Football</li> <li>Speakers</li> <li>Dyes</li> <li>Pump Hose</li> <li>Halogen</li> </ul>	<ul style="list-style-type: none"> <li>Dresses</li> <li>Shoes</li> <li>Golf Bags</li> <li>Perfumes</li> <li>Life Jackets</li> <li>Rolling Alcohol</li> <li>Berlin Jackets</li> <li>Rubber Cement</li> <li>Fishing Boats</li> <li>Vaporizers</li> <li>Balloons</li> <li>Sun Glasses</li> <li>Solvents</li> <li>Steel Fast</li> <li>Motor Oil</li> <li>Bearing Grease</li> <li>Ink</li> <li>Flour Wax</li> <li>Ballpoint Pens</li> <li>Football Cleats</li> <li>Upheavens</li> <li>Sawdust</li> <li>Beats</li> <li>Hot-Rubber</li> <li>Bicycle Tires</li> <li>Sports Car Bodies</li> <li>Hull Polish</li> <li>Fishing Lures</li> </ul>
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### The renaissance of energy innovation

Jim Skea\*

Until recently, energy had all the characteristics of a mature sector.



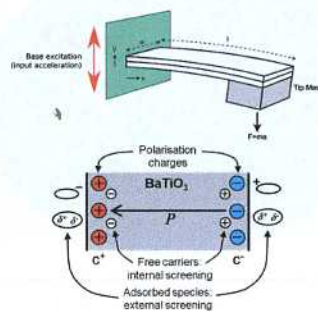
REVIEWS

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### Piezoelectric and ferroelectric materials and structures for energy harvesting applications

C. R. Bowen,\* H. A. Kim, P. M. Weaver and S. Dunn

This review covers energy harvesting technologies associated with piezoelectric materials along with the sub-classes of pyroelectrics and ferroelectrics. These properties are often present in the same material, providing the intriguing prospect of a material that can harvest energy from multiple sources including vibration, thermal fluctuations and light.

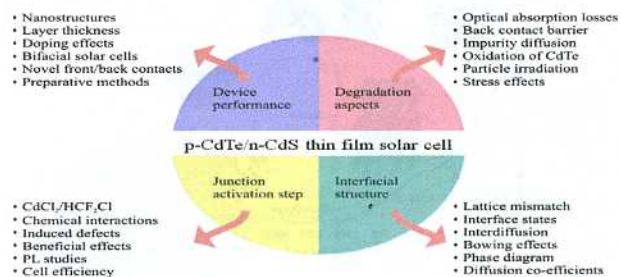


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### Physics and chemistry of CdTe/CdS thin film heterojunction photovoltaic devices: fundamental and critical aspects

S. Girish Kumar and K. S. R. Koteswara Rao\*

The factors affecting device stability and parameters influencing the device performance are reviewed.



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### Upgrading of lignin-derived bio-oils by catalytic hydrodeoxygenation

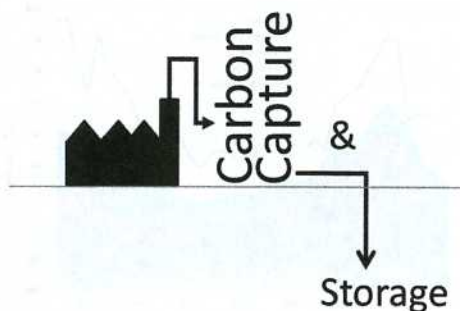
Majid Saidi, Fereshteh Samimi, Dornaz Karimipourfard, Tarit Nimmanwudipong, Bruce C. Gates\* and Mohammad Reza Rahimpour\*

The incentive for use of renewable resources to replace fossil sources is motivating extensive research on new and alternative fuels derived from biomass.





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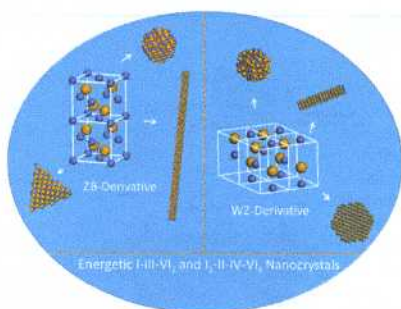


### Carbon capture and storage update

M. E. Boot-Handford, J. C. Abanades, E. J. Anthony, M. J. Blunt, S. Brandani, N. Mac Dowell, J. R. Fernández, M.-C. Ferrari, R. Gross, J. P. Hallett, R. S. Haszeldine, P. Heptonstall, A. Lyngfelt, Z. Makuch, E. Mangano, R. T. J. Porter, M. Pourkashanian, G. T. Rochelle, N. Shah, J. G. Yao and P. S. Fennell\*

A comprehensive discussion of CCS technologies, deployment and prospects across the world.

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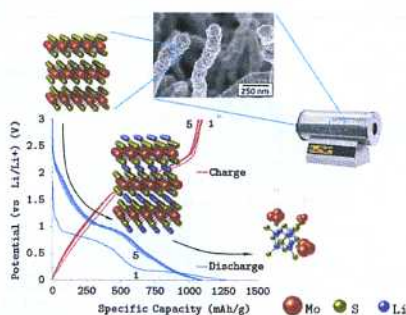


### Energetic I-III-VI<sub>2</sub> and I<sub>2</sub>-II-IV-VI<sub>4</sub> nanocrystals: synthesis, photovoltaic and thermoelectric applications

Feng-Jia Fan, Liang Wu and Shu-Hong Yu\*

Recent developments in colloidal syntheses, photovoltaic and thermoelectric applications of I-III-VI<sub>2</sub> and I<sub>2</sub>-II-IV-VI<sub>4</sub> nanocrystals have been summarized and overviewed.

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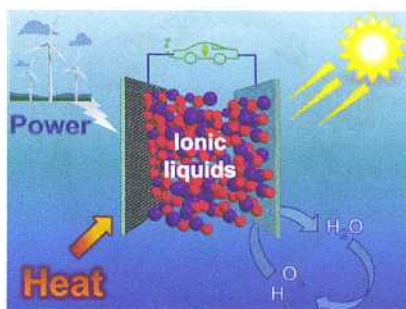
### Lithium ion battery applications of molybdenum disulfide (MoS<sub>2</sub>) nanocomposites

Tyler Stephenson,\* Zhi Li, Brian Olsen and David Mitlin\*

This work highlights the synthesis – microstructure – performance relationships for molybdenum disulfide in lithium ion batteries, conducts a comparative assessment, and identifies areas requiring further study.

## PERSPECTIVES

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### Energy applications of ionic liquids

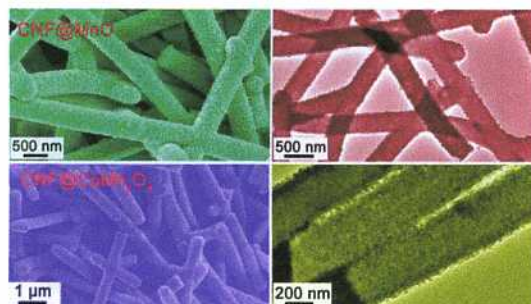
Douglas R. MacFarlane,\* Naoki Tachikawa, Maria Forsyth, Jennifer M. Pringle, Patrick C. Howlett, Gloria D. Elliott, James H. Davis Jr., Masayoshi Watanabe, Patrice Simon and C. Austen Angell

Ionic liquids offer a unique suite of properties that make them important candidates for a number of energy related applications.





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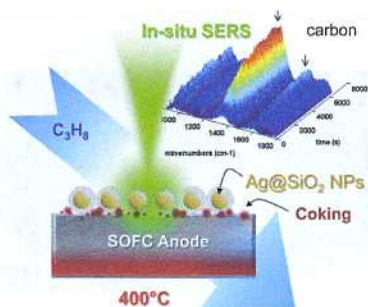


### Strongly coupled carbon nanofiber–metal oxide coaxial nanocables with enhanced lithium storage properties

Genqiang Zhang, Hao Bin Wu, Harry E. Hoster and Xiong Wen (David) Lou\*

Strongly coupled coaxial nanocables consisting of metal oxides (MnO and  $\text{CoMn}_2\text{O}_4$ ) on carbon nanofibers exhibit remarkable reversible lithium storage properties.

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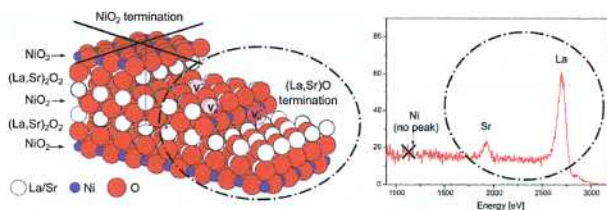


### High-temperature surface enhanced Raman spectroscopy for *in situ* study of solid oxide fuel cell materials

Xiayi Li, Jung-Pil Lee, Kevin S. Blinn, Dongchang Chen, Seungmin Yoo, Bin Kang, Lawrence A. Bottomley, Mostafa A. El-Sayed, Soojin Park and Meilin Liu\*

$\text{SiO}_2$  shell isolated Ag nanoparticles significantly amplify the Raman signals from solid oxide fuel cell electrodes, allowing identification of surface species present in trace amounts under *in situ* conditions.

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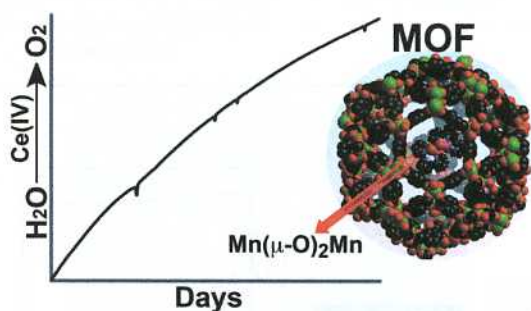


### Absence of Ni on the outer surface of Sr doped $\text{La}_2\text{NiO}_4$ single crystals

Mónica Burriel,\* Stuart Wilkins, John P. Hill, Miguel A. Muñoz-Márquez, Hidde H. Brongersma, John A. Kilner, Mary P. Ryan and Stephen J. Skinner\*

Low energy ion scattering used in combination with other surface sensitive techniques has unequivocally shown that Ni is not present in the outermost atomic layer of  $\text{La}_{2-x}\text{Sr}_x\text{NiO}_{4+\delta}$ .

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### Biomimetic di-manganese catalyst cage-isolated in a MOF: robust catalyst for water oxidation with Ce(IV), a non-O-donating oxidant

Rebecca E. Hansen and Siddhartha Das\*

Biomimetic Mn-catalyst shows sustained water oxidation with  $\text{Ce}^{4+}$  upon isolation in MOF-pores. Importance of single-molecule-cage-isolation is explored.

