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Special MRS Fall Meeting 2010 edition

Embracing materials science and working to facilitate better conditions and opportunities for discovery

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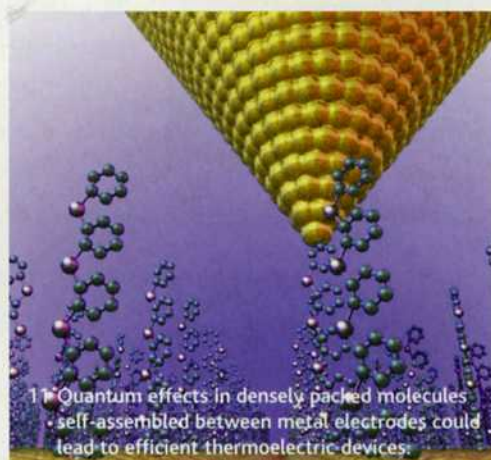
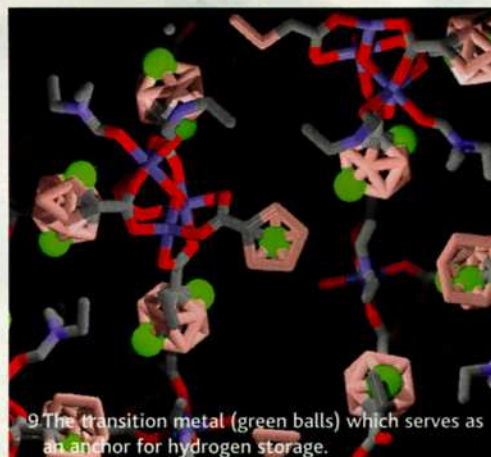
Photoresists become transparent | Polymer photovoltaics may rival semiconductor-based cells | Putting hydrogen into the framework | Solar cell acts as an artificial leaf | Concrete revolutionises road construction | Hydrogen generation | The catalyst buried deep within | Quantum effect helps reduce waste

## Updates

### ■ Application | Craig Prater *et al.*

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# materialstoday



### Cover Image

The original figure shows the mosaic structure of porous silicon (PS) in the form of the islets divided by silicon ledges. Islets represent the congestions of oxidised nanopores by itself. Formation of cracks on ledges is connected with reorganisation of superficial Si atoms as a result of difficult electrochemical reactions, including reactions of autodisproportionation. Cracks on islets appear as a result of origin of silicon ledges, that further leads to islets division. The formation of PS mosaic structure carries fractal character. The fractal character of PS mosaic structure formation takes place due to the fluctuation of electric field potential on electrolyte/semiconductor interface because of strong porosity of PS surface and the difference of the Si lattice atoms packing density on crystallography orientations.

Kurbangali Tynyshtybaev, Yuriy Ryabikin, Serebol Tokmoldin- Physico-Technical Institute, Almaty, Kazakhstan and Roman Vermenichev- Kazakh National Technical University, Almaty, Kazakhstan "Morphology of porous silicon at long etching in electrolyte with an internal source of a current" (The electron micrograph is taken with JED - 2300 JSM-6490LA, Jeol).



## Lead story 12

### Electrospinning to Forcespinning™

A new process called Forcespinning™ has been developed to make nanofibers from a wide range of materials. This new method uses centrifugal force, rather than electrostatic force as in the electrospinning process.

*Kamal Sarkar, Carlos Gomez, Steve Zambrano, Michael Ramirez, Eugenio de Hoyos, Horacio Vasquez, Karen Lozano*

## Next issue

In the next issue of *Materials Today* we turn our attention to nuclear energy

### Materials chemistry in molten salts for nuclear applications

Pyrochemistry is increasingly considered and becomes unavoidable in the nuclear field. Molten salts may find applications for fuel processing and spent fuel recycling, for heat transfer, as a homogeneous fuel and as a breeder material in fusion systems.

### The high burnup structure in nuclear fuel

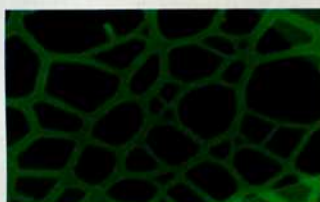
During its operating life in the core of a nuclear reactor, nuclear fuel is subjected to significant restructuring processes determined by neutron irradiation directly through nuclear reactions and indirectly through the thermo-mechanical conditions established as a consequence of such reactions.

### Fuels and materials challenges for advanced nuclear systems

Successful operation of current light water reactors and implementation of advanced nuclear energy systems is strongly dependent on the performance of fuels and materials.

A typical light water reactor (LWR) contains numerous types of materials that must all perform successfully. This review article outlines some of the challenges associated with materials and fuels for nuclear systems and describes the ATR NSUF.

## Materials science & technology issue

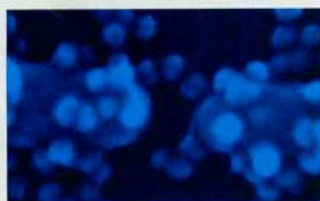


### ■ Current Research 16

#### Electrospun nanomaterials for ultrasensitive sensors

Ding *et al.*, summarize recent progress in developments of the electrospun nanomaterials with applications in sensing approaches.

*Bin Ding, Moran Wang, Xianfeng Wang, Jianyong Yu, Gang Sun*

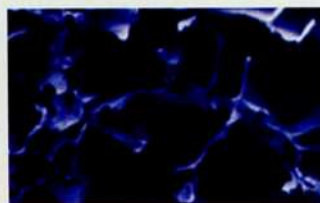


### ■ Current Research 28

#### Electrical nanogap devices for biosensing

Chen *et al.*, provide an updated overview of the work in this field, and discuss the principles of operation of electrical biosensing.

*Xing Chen, Zheng Guo, Gui-Mei Yang, Jie Li, Min-Qiang Li, Jin-Huai Liu, Xing-Jiu Huang*



### ■ Current Research 42

#### Cryogels: Freezing unveiled by thawing

Cryogels are interconnected supermacroporous gels prepared at sub-zero temperatures having applications in various research fields.

*Ashok Kumar, Ruchi Mishra, Yvonne Reinwald, Sumrita Bhat*



### ■ Current Research 46

#### Technology & swimming: 3 steps beyond physiology

Berthelot *et al.*, focus on the impact of material science in swimming.

*Geoffroy Berthelot, Stéphane Len, Philippe Hellard, Muriel Tafflet, Nour El Helou, Sylvie Escolano, Marion Guillaume, Karine Schaal, Hala Nassif, François Denis Desgorces, Jean-François Toussaint*



### ■ Current Research 52

#### Reassessing the melting temperature of PuO<sub>2</sub>

The melting behavior is a fundamental property of a material, closely related to its structure and thermodynamic stability.

*Franck De Bruycker, Konstantinos Boboridis, Dario Manara, Philipp Pöml, Matteo Rini, Rudy J. M. Konings*