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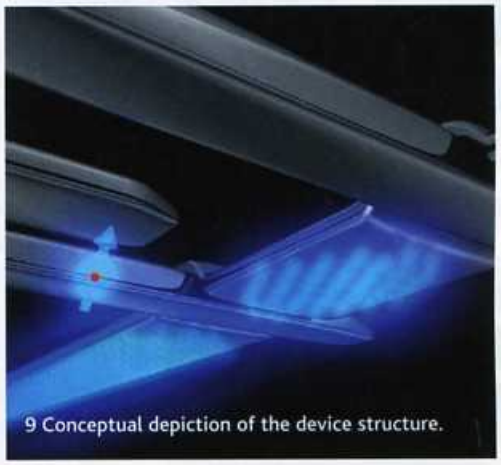
Regulars

Updates

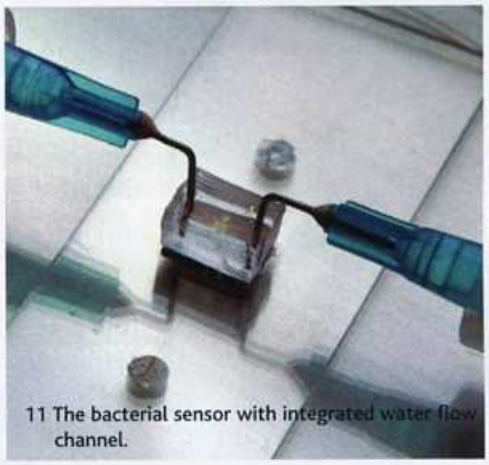
Cover Image

The original image shows a neutron tomographic reconstruction of a layer of metal hydride hydrogen storage tank during refueling hydrogen. The layer having a thickness 50 micro meter is at depth 3 mm from the top of a cylindrical tank having 90mm diameter and 20mm thickness. The tank is made up of aluminium and the filler material is $LaNi_5$. Hydrogen is supplied at pressure 10 bar to the tank through a valve the material starts absorbing hydrogen and a volume expansion occurs. The in-situ neutron tomographic images are taken during this reaction at different temperatures and hydrogen pressures to understand the factors influencing hydrogen absorption desorption phenomena. Using the tomographic technique we can precisely calculate the amount of hydrogen absorbed at each layer of thickness 50 micrometer.

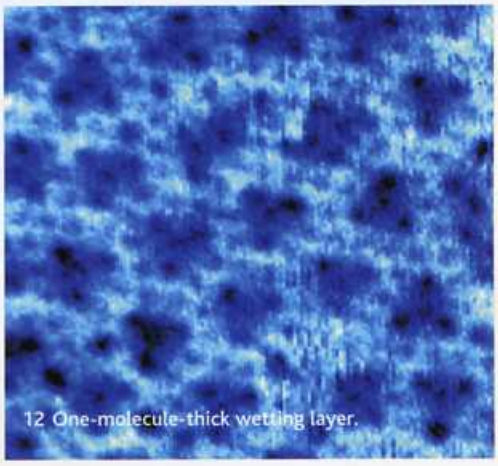
Nivas Babu Selvaraj, AGH University of Science and Technology, Poland



9 Conceptual depiction of the device structure.



11 The bacterial sensor with integrated water flow channel.



12 One-molecule-thick wetting layer.

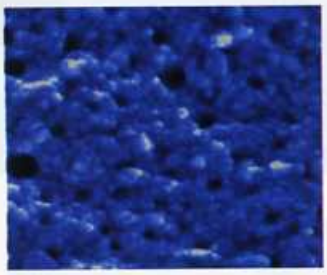
Lead story 14

Materials challenges for nuclear systems

The safe and economical operation of any nuclear power system relies heavily on the success of the fuel and the materials of construction. During the lifetime of a nuclear power system the materials are subject to high temperature, a corrosive environment, and damage from high-energy particles. The creation of the Advanced Test Reactor National Scientific User Facility is allowing researchers to test their ideas for improved fuels and materials.

Todd Allen, Jeremy Busby, Mitch Meyer and David Petti

Nuclear materials

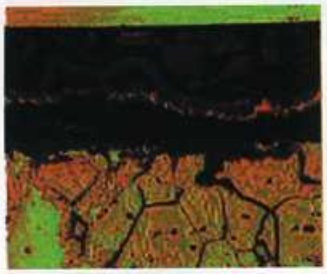


Review 24

The high burn-up structure in nuclear fuel

After four years of operation a cylindrical UO_2 nuclear fuel pellet undergoes a structural transformation in its outermost radial regions. Rondinella and Wiss review the history and consequences of this high burn-up structure in light water reactors, as well as the remaining challenge of understanding the microstructural mechanisms responsible for its formation.

Vincenzo V. Rondinella and Thierry Wiss

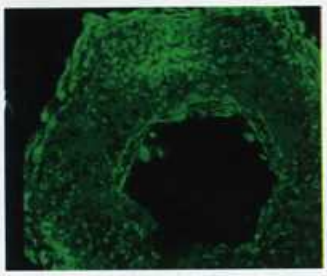


Review 34

Molten fluorides for nuclear applications

Delpech *et al.* focus on the role of molten fluoride salts in the nuclear field. Molten salts have numerous uses, including applications in fuel processing, fuel recycling and heat transfer. The thermodynamics of the corrosion in molten salts are discussed with an emphasis on understanding the mass transfer in the system, selecting appropriate metallic materials and designing effective purification methods.

Sylvie Delpech, Céline Cabet, Cyrine Slim, Gérard S. Picard



Application 42

Medical prototyping using two photon polymerization

Narayan *et al.* discuss the application of two photon polymerization to medical devices. In recent years this technique has been used to create a variety of nanostructured and microstructured three-dimensional designs, including artificial tissues, microfluidic devices and microneedles for transdermal drug delivery.

Roger J. Narayan, Anand Doraiswamy, Douglas B. Chrisey and Boris N. Chichkov

Next issue

Materials Today **hopes to take a look across the field, from nanoscale to bulk materials.**

Silsesquioxanes in nanoscale patterning applications

Silsesquioxanes are inorganic-organic hybrid materials that combine the mechanical, thermal, and chemical stability of ceramics with the solution processing and flexibility of traditionally soft materials. In this review we discuss how these attributes naturally lend themselves to a diverse range of nanoscale patterning applications.

Assembly of Ge nanofractals

Previous germanium nanostructures have consisted of one-dimensional nanomaterials such as nanowires, nanorods, nanobelts/nanoribbons, nanotubes, two-dimensional nanoscale thin films, and zero-dimensional nanoparticles, which all have integer dimensions. This article describes the assembly of non-integer dimensional germanium nanostructures, called nanofractals, by high vacuum thermal evaporation techniques.

Thermoplastic blow molding of bulk metallic glass

While plastics have revolutionized industrial design due to their versatile processibility, their relatively low strength has hampered their use in structural components. We show that bulk metallic glasses, which have superior mechanical properties, can be blow molded like plastics. The key to the enhanced processibility of bulk metallic glass formers is their amenability to thermoplastic forming, which allows complex structures to be net shaped precisely.