

# Matériaux

Bulletin de Veille - 15 février 2019

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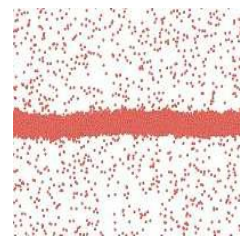
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## A LA UNE

### Nano drops a million times smaller than a teardrop explodes 19th century theory

13/02/2019 - [www.nanodaily.com](http://www.nanodaily.com)



Droplets emanating from a molecular "nano-tap" would behave very differently from those from a household tap 1 million times larger - researchers at the University of Warwick have found. Molecular simulations of liquid jets, akin to a stream of water pouring out of a nano-tap, have been used by researchers at the University of Warwick to probe the nanoscale production of droplets.

### Growing interest of LCA and eco-design within the European space sector

08/02/2019 - [blogs.esa.int](http://blogs.esa.int)

This launcher study was completed in 2012 and updated in 2014 and considered the life cycle impacts of the exploitation phase including the production & assembly, the launch campaign and the launch event. One example is that of the two competing Earth Explorer 9 concepts FORUM and SKIM, FORUM would measure radiation emitted from Earth across the entire far-infrared part of the electromagnetic spectrum, while SKIM would measure ocean surface currents with a novel multi-beam Doppler-based approach.

## GÉNÉRALITÉS - MATÉRIAUX

### Superinsulators to become scientists' quark playgrounds

06/02/2019 - [www.spacedaily.com](http://www.spacedaily.com)

An international group of scientists that includes materials scientist Valerii Vinokur from the U.S. The theory of superinsulators fleshes out a mental model that high-energy physicists can use to think about quarks, and it offers a powerful laboratory for exploring confinement physics using easily accessible materials. To discover how to synthesize a 2D or 3D superinsulator, researchers need "a full understanding of what makes one material three-dimensional and another two-dimensional," Vinokur said.

### Artificial intelligence ARTIST instantly captures materials' properties

30/01/2019 - [www.sciencedaily.com](http://www.sciencedaily.com)

Researchers at Aalto University and the Technical University of Denmark have developed an artificial intelligence (AI) to seriously accelerate the development of new technologies from wearable electronics to flexible solar panels. ARTIST, which stands for Artificial Intelligence for Spectroscopy, instantly determines how a molecule will react to light -- clinch-pin knowledge for creating the designer materials needed for tomorrow's technology. The multidisciplinary team trained the AI in just a few weeks with a dataset of more than 132,000 organic molecules.

## MATÉRIAUX POUR L'ÉNERGIE

### Researchers Develop New Materials for Supercapacitors with Higher Voltage and Better Stability

08/02/2019 - [www.azom.com](http://www.azom.com)

dimensional micro- and nanostructures

- Laser-induced graphene gets tough, with help

## POLYMÈRES - ÉLASTOMÈRES

- Chemistry Researchers Use Block Copolymers to Create First Carbon Fibers with Uniform Porous Structure
- Researchers Use Fiber-Reinforced, Thermosetting Plastics to Make Directly-Cooled Electric Motor

## REVÊTEMENTS

- Scientists image conducting edges in a promising 2D material
- Material Removes Ice Buildup Without Power or Chemicals

The new material is a sheet composed of a continuous three-dimensional framework of graphene mesosponge, a carbon-based material which has nanoscale pores. In addition, they tested commercial graphene-based materials, including reduced graphene oxides, 3D graphene, and single-walled carbon nanotubes using activated carbons as a standard for comparison. Notably, it exhibited ultra-high stability at 25 °C and 4.4 V, which is 2.7 times greater when compared to traditional activated carbons and other graphene-based materials.

## Harvesting energy from wireless signals to power 3D printed IoT device

01/02/2019 - [www.3ders.org](http://www.3ders.org)



For the prototype, fractal antennas were screen printed with silver onto 3D printed plastic squares that then connect together to form a cube covered in antennas. The team used a simple shape to demonstrate proof of concept because screen printing silver is easiest on flat surfaces, but there exist advanced 3D printers that could embed the antennas directly into the housing of a device that has a more complex shape.

## BIOMIMÉTIQUE

### Slime-fighting slug can superglue enemy frogs to trees for days

13/02/2019 - [www.newscientist.com](http://www.newscientist.com)



A green tree frog was discovered stuck on a branch next to a red triangle slug (left) Many animals have extraordinary defence mechanisms, from the sea cucumbers that expel their entrails through their anuses to the exploding ants that blow themselves up to protect the colony. At least two other species of slugs also produce sticky mucus, but these have only been studied in the lab.

### Magnetic teeth hold promise for materials and energy

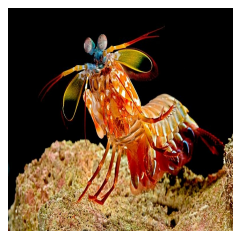
05/02/2019 - [www.spacedaily.com](http://www.spacedaily.com)



A mollusk with teeth that can grind down rock may hold the key to making next generation abrasion-resistant materials and nanoscale materials for energy. A better understanding of the biomineralization process, combined with a thorough understanding of chiton tooth architecture and mechanics, could help scientists not only improve wear-resistant coatings and tooling, but also help grow nanoscale materials for energy and water-based applications.

### Camera Mimics Mantis Shrimp's Astounding Vision

01/02/2019 - [www.scientificamerican.com](http://www.scientificamerican.com)



Mantis shrimp hold the title for the fastest punch in the animal kingdom—powerful enough to break seashells and aquarium glass. Engineers at the University of Illinois at Urbana-Champaign have now made a camera that closely copies the crustacean's impressive visual system. Pictures from the shrimp-eye camera had much higher contrast, especially in foggy and rainy conditions and in scenes with a lot of light and shadows, Gruev says.

### 3D printed wing evolution to faster flight

01/02/2019 - [www.3ders.org](http://www.3ders.org)

Mathematicians at New York University 3D printed 15 generations of algorithmically-bred wing designs to determine what shapes were best for flapping. " 3D printing makes these kinds of iterative, generational designs incredibly affordable; the costs of fabricating these wings with subtractive manufacturing methods would have limited the team to only a couple iterations, drastically reducing the optimization that was achieved with multiple iterations.

## COLLAGES –ADHÉSIFS

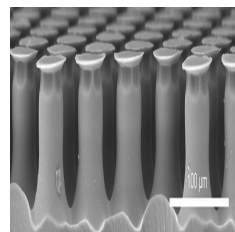
### Research details sticky situations at the nanoscale

07/02/2019 - [www.sciencedaily.com](http://www.sciencedaily.com)

At very small scales, a family of adhesive forces called van der Waals forces dominate. So from a practical perspective, if we want to engineer at those scales, we need a more complete theory of how adhesive forces deform and shape material surfaces, and coupled with surface roughness affect how surfaces stick to, and slip over one another.

### Method Increases Adhesive Properties of Silicone

01/02/2019 - [www.techbriefs.com](http://www.techbriefs.com)

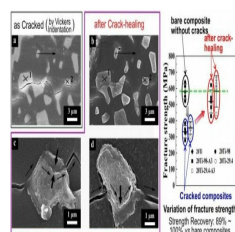


Geckos, spiders, and beetles have special adhesive elements on their feet, enabling them to easily run along ceilings or walls. Under a scanning electron microscope, the surface of the silicon elastomer with its mushroom-like adhesive elements becomes visible. Researchers have succeeded in boosting the adhesive effect of a silicone material significantly by combining two methods. (©Emre Kizilkan) The researchers have improved the adhesive properties of silicone elastomers by mimicking the surface structure of certain male leaf beetles (Chrysomelidae).

## CÉRAMIQUES

### Simple and low-cost crack-healing of ceramic-based composites

12/02/2019 - [www.sciencedaily.com](http://www.sciencedaily.com)



A team of researchers at Osaka University demonstrated that cracks induced in composites consisting of alumina (Al<sub>2</sub>O<sub>3</sub>) ceramics and titanium (Ti) as dispersed phase could be healed at room temperature, a world first. This ceramic healing method permits crack-healing even in a state in which ceramic parts are mounted on devices at a low cost and without using complicated high-temperature heat treatment processes that require significant amounts of energy.

### Nano-infused ceramic could report on its own health

06/02/2019 - [www.nanodaily.com](http://www.nanodaily.com)

The research led by Shahsavari and Asghar Habibnejad Korayem, an assistant professor of structural engineering at Iran University of Science and Technology and a research fellow at Monash University in Melbourne, Australia, appears in the American Chemical Society journal Applied Materials and Interfaces. Graphene is a well-studied form of carbon known for its lack of a band gap - the region an electron has to leap to make a material conductive. White graphene, with its wide band gap, is an insulator.

## MÉTAUX

### Researchers Conduct 3D Experiments to Better Understand Shape Memory Alloy

14/02/2019 - [www.azom.com](http://www.azom.com)

Specifically, she used far-field and near-field high-energy diffraction microscopy (HEDM), which come under the bandwidth of 3D X-Ray Diffraction methods, enabling her to picture the material's interior microstructure in three dimensions while it is reacting in real time. The first paper, "Measuring stress-induced martensite microstructures using far-field high-energy diffraction microscopy," published in September in Acta Crystallographica Section A: Foundations and Advances, aimed to predict the specific type of martensite that would develop.

### Observing hydrogen's effects in metal

05/02/2019 - [www.sciencedaily.com](http://www.sciencedaily.com)

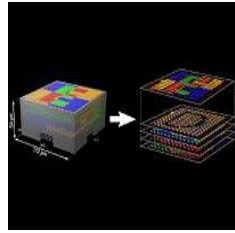
Now, researchers at MIT have figured out a way around that problem, creating a new

technique that allows the observation of a metal surface during hydrogen penetration. The key to the new monitoring process was devising a way of exposing metal surfaces to a hydrogen environment while inside the vacuum chamber of a scanning electron microscope (SEM). The top of the metal is exposed to the SEM electron beam, which can then probe the structure of the metal and observe the effects of the hydrogen atoms migrating into it.

## NANOMATÉRIAUX

### Customized mix of materials for three-dimensional micro- and nanostructures

14/02/2019 - [www.nanodaily.com](http://www.nanodaily.com)



In their publication "Multimaterial 3D Laser Microprinting Using an Integrated Microfluidic System" in Science Advances, the researchers report that they used the integrated system to produce three-dimensional microstructured security features from seven different fluids: a non-fluorescent photoresist as backbone, two photoresists with different fluorescent quantum points, two photoresists with different fluorescent dyes, and two developer fluids.

### Laser-induced graphene gets tough, with help

12/02/2019 - [www.sciencedaily.com](http://www.sciencedaily.com)

The Tour lab first made LIG in 2014 when it used a commercial laser to burn the surface of a thin sheet of common plastic, polyimide. To make the composites, the researchers poured or hot-pressed a thin layer of the second material over LIG attached to polyimide. When the liquid hardened, they pulled the polyimide away from the back for reuse, leaving the embedded, connected graphene flakes behind. Composites made with liquid additives are best at preserving LIG flakes' connectivity.

## POLYMÈRES - ÉLASTOMÈRES

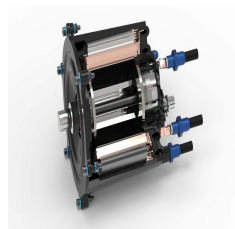
### Chemistry Researchers Use Block Copolymers to Create First Carbon Fibers with Uniform Porous Structure

05/02/2019 - [www.azom.com](http://www.azom.com)

The weight of carbon fibers improves fuel and energy efficiency, producing faster jets and vehicles. PAN is well-known in the polymer chemistry field as a precursor compound to carbon fibers, and PMMA acts as a place-holding material that is later removed to create the pores. One half of the compound polymer is PAN, and the other half is PMMA, and they're covalently bonded in the middle. In this step, the PAN and PMMA naturally separated and self-assembled into the strands of PAN and uniformly scattered domains of PMMA.

### Researchers Use Fiber-Reinforced, Thermosetting Plastics to Make Directly-Cooled Electric Motor

04/02/2019 - [www.azom.com](http://www.azom.com)



When it comes to making lighter electric cars, the weight of the motor also needs to be reduced. They also lend themselves to complex geometries without requiring post-processing, so we made some real savings on overall weight and cost. Fiber-reinforced, thermosetting plastics were eventually selected by the project partners because they have high resistance and high-temperature resistance to aggressive coolants. Using a thermally conductive epoxy resin molding compound, the stators themselves are over-molded in a transfer molding process.

## REVÊTEMENTS

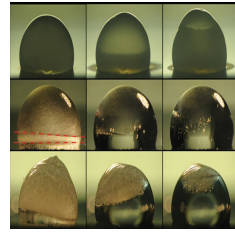
### Scientists image conducting edges in a promising 2D material

08/02/2019 - [www.sciencedaily.com](http://www.sciencedaily.com)

In topological insulators, a special type of material, the interior works as an insulator, but the boundaries of such materials are guaranteed to be conductive due to its topological property, resulting in a feature called "topological edge conduction. WTe<sub>2</sub> layers are stacked together via van der Waals interactions and can be easily exfoliated into thin, 2-D, graphene-like sheets.

### Material Removes Ice Buildup Without Power or Chemicals

01/02/2019 - [www.techbriefs.com](http://www.techbriefs.com)



The next two rows show the droplet thawing out on a surface coated with the new layered material. (The Varanasi Research Group) A completely passive, solar-powered system was developed that is based on a three-layered material that can be applied or even sprayed onto the surfaces to be treated. The material absorbs 95 percent of the incident sunlight and loses only 3 percent to reradiation. Finally, the bottom layer is simple foam insulation to keep any of the heat from being wasted downward and keep it where it's needed at the surface.

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