

MINA-NEWS

MINATEC
NEWSLETTER
JUNE '19

TOP NEWS

Aledia invests in own R&D facility

Aledia has been housed at MINATEC Entreprises for seven years. Today, the company is investing €20 million in a 4,000 sq. m facility in Echirolles, near Grenoble. The new facility, which will be equipped with Aledia's own machines, will be dedicated to R&D as Aledia prepares to launch production within the next two years.

Compared to the OLEDs and liquid crystals in today's displays, Aledia's silicon nanowire LEDs offer higher brightness and energy efficiency and generate the three basic colors from a single chip. These advantages position Aledia to penetrate some huge markets, including smartphones. The market is so big that if just 20% of smartphone displays switched to LED technology, the manufacturing capabilities required would surpass those of TSMC, the world's leading semiconductor manufacturer.

SPEEDING UP R&D

To gear up for volume manufacturing, Aledia, which currently has 90 employees, is moving to Echirolles, near Grenoble. The company's primary objective is to speed up R&D to rapidly align its products with customer specifications. At the same time, Aledia is starting to work with a foundry with a view to launching production within two years. For the past seven years, Aledia has been housed at MINATEC Entreprises, where it was able to grow without making substantial investments in equipment, most notably by using the CEA's facilities. The company is leaving MINATEC Entreprises, but will stay in the Grenoble area. Aledia also plans to build 1,400 sq. m of cleanrooms at its new site. The Grenoble microtechnology startup scene has not seen a project of this scale in years.

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INNOVATION

Error-correcting codes: Is the quantum computer possible?

Quantum error-correcting codes were developed by mathematicians to check the variability of the state of each qubit. But are the codes relevant in practical terms? A physicist at IRIG investigated the issue and his conclusions are not optimistic. He noted that the theories use error models that fail to factor in errors that are rare, but that are nevertheless detrimental to computing precision.

In concrete terms, the error-correcting codes would have to make these errors a quadrillion times less frequent for the quantum computer to produce reliable results. Needless to say, this hypothesis is very unlikely. The study, published in *Physical Review*, is one of the first to issue a negative verdict, garnering substantial interest.

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Micro-LEDs: Low-cost mass production within reach

In mid-May Leti presented a promising micro-LED fabrication technology at a conference in the United States. The technology would make it possible to fabricate micro-LEDs at a very low cost and transfer the LEDs onto all types of substrates—rigid, flexible, transparent, or opaque—with no limits on size. In the future, consumers could even order custom TV screens tailored to the size and layout of their living rooms! Here is how it works: Each pixel's micro-LEDs are fabricated directly on the associated CMOS command circuit, eliminating the need to transfer the LEDs one by one onto TFT glass plates containing the command circuit—the only solution until now. Leti is seeking partners to scale the innovation up and commercialize it within the next four to five years.

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Progress toward 3D-printed electronic circuits

Imagine 3D printing antennas and connections between components or sensors directly onto plastic enclosures or other plastic parts. LGP2* and IMEP-LaHC are working on just that in PhD research being conducted under an industrial excellence chair. The research is focusing on the development of industrial processes, functional (conductive, resistive, nanoparticle-based, etc.) inks, and annealing methods compatible with plastics. The goal is to build functional prototypes.

The use of six-axis printing for 3D objects would eliminate the need for PCB-type circuits and could also be employed to add functions to existing objects or to place functions outside of objects to save space. Schneider Electric, which funds the industrial excellence chair, is keeping a close eye on the research and is providing input into all of the recommendations and tests.

*The Grenoble Institute of Technology Paper-industry Engineering Lab

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Deep learning a threat to hardware encryption

Deep learning could be used to crack the encryption codes used to safeguard secure products. Leti's CESTI* studied the threat in research that recently resulted in a PhD dissertation that earned broad international recognition.

The research focused on attacks via auxiliary channels. These attacks log massive amounts of data on a chip's electricity consumption and electromagnetic emissions, and then use deep learning algorithms to analyze the data and crack the cryptographic codes.

The PhD dissertation that resulted from the research put forward a type of attack that CESTI can now measure and implement when conducting evaluations. CESTI is now also poised to join France's National Cybersecurity Agency (ANSSI) in raising developers' awareness of this new threat.

*Information technology security evaluation center

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Miniaturized chemical sensor integrated on silicon

Researchers from Leti successfully integrated a high-performance chemical sensor on silicon. The system's quantum cascade lasers, photoacoustic cell, and photonic circuit take up less than 1 cm³; the conventional system originally took up around a liter. The lasers produce light in the mid-infrared spectrum, which means that they can detect a broad range of gases. The sensor, compact enough to be integrated into a smartphone, will target the medical and environmental markets. The researchers are pursuing their work, and are now investigating ways to fit additional optical sources into the same form factor for even wider detection capabilities. A few test batches have been manufactured and Leti is working with startup MirSense and is also seeking partners to cover other applications. Leti has filed two patents to protect the innovation.

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MRAM memory gets new recipe

Researchers at Spintec have come up with a new way to improve MRAM memory retention, using tungsten instead of tantalum in the magnetic tunnel junction stacks. When the stacks are made, they must be annealed to crystallize the junctions. During annealing, the tantalum tends to diffuse toward the tunnel barrier, absorbing oxygen in the process. It also absorbs some of the iron in the magnetic electrode, modifying the electrode's chemical composition. These phenomena alter MRAM magnetoresistance and retention (how long information can be stored).

This undesirable effect occurs at temperatures greater than 300 °C; annealing can take place at temperatures of 400 °C. Therefore, it is a good idea to replace the tantalum with tungsten, which migrates less and captures less iron during annealing.

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A new step forward toward very-high-density magnetic storage

Grenoble-based researchers from IRIG working at ESRF successfully obtained a single layer of graphene on single-crystal iridium with a periodicity of 2.5 nm using a CVD reactor. Materials research institute Institut Lumière Matière in Lyon had previously obtained iron-platinum nanoparticles, organized them at the atomic scale, and given them magnetic properties. Here, the two teams joined forces, depositing the nanoparticles developed in Lyon onto the substrate developed in Grenoble to create what could one day become an ultra-high-density storage medium. As a comparison, currently the smallest memory points are 72 times larger (15 nm x 30 nm).

The teams are now working together to deposit iron-platinum nanoparticles onto other nanostructured substrates.

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OLEDs undergo biocompatibility testing

Researchers from LMGP and Leti tested OLEDs developed by Leti for microdisplays for toxicity to determine whether the OLEDs could be used in biological environments. The researchers monitored the growth of two cultures (one cellular and one bacterial) in which an OLED had been placed and compared growth to control cultures. They found that the OLED did not negatively impact cell or bacteria growth—proof that the silver and aluminum in the OLEDs do not cross the devices' encapsulation material.

Compared to the LED lights currently used by biologists, Leti's high-emission OLED could deliver more precise light excitation by placing the cell just a few microns from the pixel.

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DAY BY DAY

Patents: CEA remains very active

France's National Industrial Property Institute (INPI) released its 2018 ranking of patent filers. The CEA held on to its fourth-place ranking, coming in just behind three industrial corporations (Valeo, PSA, and Safran) with 674 patent applications published. This was the CEA's best year ever with the exception of 2016 and 2017 (684 applications).

It is also important to point out that Grenoble-based research in micro and nanoelectronics fuels a large part of the CEA's patents—something that is not reflected in the INPI ranking. And the CEA's main industrial partners for this type of research are also very well ranked. STMicroelectronics ranked 13th with 168 patent applications, and Soitec ranked 46th in the nation and first for mid-sized companies (250 to 5,000 employees).

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DAY BY DAY

LMGP: Daniel Bellet named Scientific Director of Carnot energy institute

On March 1, Daniel Bellet (LMGP, Phelma) succeeded François Weiss as Scientific Director of *Institut Carnot Énergies du Futur*. He will occupy the position with a co-director from Liten, which is the institute's coordinator and partner.

LMGP is currently overseeing two Carnot projects. The first, called Eco-LED is developing low-cost, high-performance, easy-to-recycle white LEDs that ensure high visual comfort. The LEDs will combine a UV LED with a new generation of luminophore powder made from amorphous aluminoborate powders. The second project, Free, is developing efficient, long-lasting energy generators that convert ambient mechanical energy into electricity.

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Deposition techniques: ALD gains traction

Atomic layer deposition (ALD) has become a technique of choice for depositing very thin films. However, the technique does have the disadvantage of being very slow. For the first time ever, speeding up the process appears to be within reach. A recent article by David Muñoz-Rojas (LMGP), Tony Maindron (Leti), and other ALD experts outlined four approaches that substantially reduce deposition times: batch ALD (processing several substrates simultaneously); spatial ALD (developed and used at LMGP, this approach is 100 times faster than conventional ALD); optimized geometries and reactor operation; and adjusting the process (the injection-purge sequence). The authors also pointed out the role of modelling in speeding up the ALD process. All of this is good news for faster ALD!

Read full article: <https://bit.ly/2K7lbyX>

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French Chemistry Society recognizes young researcher from Phelma

Vivien Gatard graduated from Grenoble Institute of Technology's Phelma engineering school in 2018. He recently won the French Chemistry Society's "Master's in Electrochemistry Internship" award for the Master's thesis he completed during his internship at LEPMI (a lab specializing in the electrochemistry and physiochemistry of materials and interfaces). While Vivien was enrolled in the Physics-Nanosciences (PNS) program, he decided to devote his third-year internship to green hydrogen production via water electrolysis under an intense alternating magnetic field.

His passion for the topic led him to pursue his research at LEPMI, where he is currently working toward his PhD. The purpose of the novel electrolysis method is to sustainably produce pure hydrogen in large quantities at a cost that can compete with polluting hydrogen-production techniques using fossil-based energy.

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Grenoble Institute of Technology-Phelma increasingly international

Grenoble Institute of Technology's Phelma engineering school is aiming for 100% international mobility. To achieve this goal, the school is actively and rapidly expanding its network of international partners. Several new dual-degree programs will be available starting in September 2019 with China (IFCEN*-Sun Yat-Sen), Tunisia (National Engineering School of Tunis), and Lebanon (Lebanese University-Beirut). These new dual-degree programs will bring the total offered by Phelma to more than 70. In addition, the number of exchange programs with new destinations like Malaysia (UT-Petronas) and Russia (ETU-St. Petersburg) is also growing. Finally, Phelma is also engaged in other types of partnerships that include exchange programs. For example, the school is coordinating Brafisat, a new Franco-Brazilian scientific cooperation on micro and nanosatellites.

*IFCEN: Sino-French Institute for Nuclear Energy

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IRIG researchers awarded three ERC Advanced grants

Of the 31 ERC Advanced grants awarded by the European Research Council (ERC) to researchers in France at the end of March, five were given to researchers in Grenoble, and three went to researchers at IRIG. Martin Blackledge is investigating the structural and dynamic behavior of viral-replication machines. Renaud Demadrille is developing dye-sensitized photovoltaic cells with variable self-adjustable optical transmission. And Giovanni Finazzi is studying photosynthesis in marine plankton, which is capable of absorbing almost as much CO₂ as rain forests. ERC Advanced grants are awarded to established researchers with at least twelve years of research activity after their PhD. The grants can be for up to €3.5 million per project, including €1 million for equipment or access to large scientific instruments. The exact amount of the grant is determined on a case-by-case basis for each project.

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The Startup Café is back!

A special Startup Café was held on March 21 to kick off the Challenge First Step competition. The next Startup Café is scheduled for Thursday, June 6, 2019 from 1 p.m. to 2 p.m. at Maison MINATEC. The topic will be "Scaling up for manufacturing: the keys to success." Scale-up expert Thierry Chavignier, VP Manufacturing, Aryballe Technologies, will speak and take questions from the audience. The friendly, relaxed Startup Café meetings are open to anyone on the MINATEC and GIANT campuses interested in creating a startup and are designed to share the experiences of entrepreneurs who have "been there" with those just beginning to face the challenges of starting their own company.

The next Startup Café will be held on September 12, 2019 on teamwork and on November 14, 2019 for a showcase of success stories.

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First-year Phelma student **Marie Caillaux** talks about her experience “sharing science” with elementary-school children

“We kept the focus on hands-on learning!”

MINA-NEWS: Why would a 20-year-old engineering student want to get involved with a bunch of ten-year-olds?

Marie Caillaux: I liked the idea of having to figure out how to explain things and convey my passion for science. I chose “sustainable cities” as my topic. We worked with my partner (another Phelma student) and high-school juniors involved in the project to focus in on the home and heat insulation. The kids really liked it.

MINA-NEWS: How did you address the scientific aspects of your topic?

MC: We kept the focus on hands-on learning, with simple experiments on a cardboard model of their school. We used a lamp to represent the sun, which we moved around the model. The kids had to measure the temperature and light with the sun at different positions. We compared the temperatures measured on a slab of raw concrete and a wooden board with one end immersed in cold water. Next, we added a polystyrene panel and took the measurements again. This got us talking about the impact of construction and insulation materials.

MINA-NEWS: What were the key points of the report you wrote on the project?

MC: The kids already had a lot of knowledge, and they were right about many things—like the physical and thermal properties of different materials—and they want to learn more. Going into the project, I had no idea how complicated it would be to organize the two post-project presentations, which were attended by around 300 people. I learned a lot about planning and being patient! ■

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Ginsen summer school to welcome 30 international participants

Grenoble Institute of Technology will host 30 students and teachers from around the globe (the United States, Australia, China, India, Nigeria, and other countries) for its Ginsen (Grenoble International Smart Engineering Summer School) program. As in previous years, this year’s Ginsen will focus on micro and nanotechnology. And, for the second year running, new energy technologies will also be addressed. The participants will benefit from 45 hours of classroom teaching on their chosen topic and 45 hours of core courses in the humanities, including project management.

Grenoble Institute of Technology’s Phelma engineering school is responsible for the micro and nanotechnology curriculum and will hold lecture classes and cleanroom and showroom tours at MINATEC. The teachers are from several European countries.

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ESONN 2019 garners 200 applications for 50 slots

The 2019 edition of ESONN* garnered more than 200 applications from PhD candidates and junior researchers from around the world for fewer than 50 slots, confirming the summer school’s stellar reputation. ESONN is co-organized by the CNRS, CEA, Grenoble Institute of Technology, and Grenoble-Alpes University from August 25 to September 14. The curriculum is equally divided between lectures in nanophysics and nanoscience for biology and lab classes, some of which will take place at MINATEC. The classes will be taught by faculty from several European countries, and certain lectures will be given by Grenoble-based researchers. ESONN provides PhD candidates and junior researchers with an opportunity to expand their knowledge and learn new skills. In many cases, the participants also lay the groundwork for future postdoctoral or other research in Grenoble.

*European School on Nanosciences and Nanotechnologies

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E-health: Ludocare to deliver 500 companion robots in September

Lyon-based startup Ludocare was co-founded in 2017 by ENSPG (now Phelma) alumnae Élodie Loisel, who is currently the company’s VP R&D. Ludocare develops connected solutions for children suffering from chronic disease. The company’s two companion robots, Joe (for asthma) and Leo (for cystic fibrosis), provide sick children with fun reminders like when and how to take their medication and give motivating rewards. Parents can configure the reminders using a special mobile app. Ludocare recently raised €25,000 via a crowdfunding campaign, and used the funds to start scaling up the technology for manufacturing. A first batch of 500 robots, 100% manufactured in the Auvergne-Rhône-Alpes region, will be ready in September and sold through a monthly subscription plan.

Learn more at: <https://ludocare.com/>

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HORIZONS

Puya Internationale moves headquarters to Grenoble

Puya Internationale, a non-profit dedicated to scientific cooperation, was founded in 2004. The group recently moved its headquarters from Cachan to Grenoble, where the majority of its most active members are located. Puya Internationale initially focused on Franco-Peruvian cooperation, and gradually expanded its scope across Latin America and, later, to other continents. The group’s objective is to promote and encourage scientific and technical cooperation between France and universities in emerging countries leveraging a strong network of partners that includes MINATEC.

This year, Puya Internationale is involved in several science-related events, including the Nanoandes and MEMS-Latam (formerly MEMS AL) schools in Chile, the MINATEC school in Vietnam, and a characterization school in Morocco.

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Dr. Alim-Louis Benabid to speak at 400th Midi MINATEC brown-bag lunch series

Dr. Alim-Louis Benabid needs no introduction. The neurosurgeon, physicist, and founder of the Clinatéc biomedical research center will be the speaker at the 400th Midi MINATEC brown-bag lunch series on September 13, 2019.

A member of the prestigious French Academy of Science and 2014 winner of the Lasker, Award (known as America's Nobel Prize) for his work on Parkinson's disease, Dr. Benabid also won the European Patent Office's European Inventor Award in 2016 for his high-frequency deep-brain stimulation method that drastically reduces the symptoms of Parkinson's disease.

The Midis MINATEC lunch talks were established in 2007. Since then, they have brought in an impressive 77,000 attendees and their popularity has never waned, with an average audience of 330 people in 2019. The weekly lectures are open to the general public.

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Ideas Days 2019 to delve into technology and resilience

T rue to form, Ideas Laboratory will cross the boundaries between scientific disciplines and cultures at Ideas Days 2019, to be held on July 4 and 5, 2019. This year's topic is "Technology and resilience: Utopia or balancing act?". The event will interrogate whether or not science and technology can create hope and meaning in a highly-complex and unpredictable world. The day-and-a-half-long program includes around fifteen speakers who will facilitate five talks.

The event will begin and end with talks by Luc Schuiten, the architect who pioneered plant-inspired "vegetal cities," and by historian and futurist Mathieu Baudin. A quartet will play jazz and 40s-style swing on the evening of July 4.

Learn more at: <https://www.ideas-days.com>

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AGENDA

June 6 [Maison MINATEC]
STARTUP CAFÉ: "SCALING UP FOR MANUFACTURING: THE KEYS TO SUCCESS."
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Ends on June 7 [Les Houches]
SPRING SCHOOL ON BIOLOGY AT DIFFERENT SCALES
ORGANIZED BY IRIG AND IBS
<http://leshouches.strikingly.com/>

Ends on June 6 [Grenoble]
GLOBAL CHALLENGES SCIENCE WEEK
<https://edu.univ-grenoble-alpes.fr/science-week>

June 11 to July 12 [Grenoble]
GINSEN: GRENOBLE INTERNATIONAL SMART ENGINEERING SUMMER SCHOOL
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June 13, MC2 [Grenoble]
NATIONAL FINALS OF THE THREE-MINUTE THESIS COMPETITION
(MA THÈSE EN 180 SECONDES)
<http://mt180.fr/>

June 14 [Grenoble Institute of Technology-Phelma]
HALF-DAY CONFERENCE ON INTEGRATED MEASUREMENT SYSTEMS
<https://bit.ly/2X8imRS>

June 18 [Maison MINATEC]
ADMINISTRATIVE ASSISTANTS EVENT
<https://bit.ly/30F4514>

June 24-28 [Grenoble]
LETI INNOVATION DAYS 2019
www.leti-innovation-days.com
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June 27 [Grenoble Institute of Technology Auditorium, MINATEC]
SPECIAL TALK BY CÉDRIC VILLANI "FOR A MEANINGFUL ARTIFICIAL INTELLIGENCE"
CO-ORGANIZED BY THE LETI INNOVATION DAYS AND MIDI MINATEC
Contact and registration:
<https://www.minatec.org/midis>

July 4-5 [Ideas Laboratory]
"TECHNOLOGY AND RESILIENCE: UTOPIA OR BALANCING ACT?"
<https://www.ideas-days.com>

August 25-September 14 [Grenoble]
ESONN: EUROPEAN SCHOOL ON NANOSCIENCES AND NANOTECHNOLOGIES
<https://www.esonn.fr>

September 13 [MINATEC]
400th MIDI MINATEC BROWN BAG LUNCH TALK WITH DR. ALIM-LOUIS BENABID
Registration to open in September
<https://www.minatec.org/midis>

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Editing: Benoît Playoust and Bénédicte Magne | Graphic design: studio kolza [Lyon] | English translation: SFM Traduction