



Show Notes 16 February 2024

Story 1: Liquid metal RAM is first step towards shapeless computing — as well as spineless robots with octopus-like features and robots from a popular 90's Sci-Fi movie.

Source: Techradar.com

Story by Wayne Williams

Link: <https://www.techradar.com/pro/liquid-metal-ram-is-first-step-towards-shapeless-computing-as-well-as-spinless-robots-with-octopus-like-features-and-robots-from-a-popular-90s-sci-fi-movie>



(Image credit: Jing Liu/Tsinghua University)

- WARNING – THIS IS VERY GEEKY STUFF I DON'T PRETEND TO FULLY UNDERSTAND! 😊
- Storage systems are critical parts of electronic devices, but current methods have struggled to create flexible memory due to inherent rigidity limitations.
- In a breakthrough that brings to mind the T-1000 robot from the movie Terminator 2, researchers from [Tsinghua University in Beijing](https://www.tsinghua.edu.cn/) have developed a fully flexible resistive random-access-memory device, known as FlexRAM, using a gallium-based liquid metal to write and read data.

- Note – gallium is a soft, silvery-white metal, similar to aluminum.
- This new liquid metal [RAM](#), which can withstand nearly any deformation, uses reversible electrochemical oxidation to modulate the overall conductivity of the target liquid metals.
 - **Side note, what is electrochemical oxidation?** [Electrochemical oxidation](#) is a very efficient advanced oxidation method [typically] used to degrade pharmaceuticals in wastewater. This method involves two mechanisms:
 - The first mechanism is direct [anodic oxidation](#) by removing electrons at the anode.
 - The second possible mechanism is indirect anodic oxidation by aggressive intermediates. The electrode material must have high electrical conductivity, high chemical resistance, and low cost.
- Published in the journal [Advanced Materials](#), the research details how gallium-based liquid metal droplets undergo oxidation and reduction mechanisms in a solution environment that mimics the hyperpolarization and depolarization of neurons [nerve cells]. This unique process allows the writing of 1s and 0s, with a low voltage oxidizing the liquid metal to represent “1” and a reverse voltage returning the metal to its low-resistance state of “0”.
 - **Side note** - Hyperpolarization is when the membrane potential becomes more negative at a particular spot on the neuron's membrane, while depolarization is when the membrane potential becomes less negative (more positive).
- To demonstrate the functionality of FlexRAM, the Tsinghua University in Beijing team encoded a string of letters and numbers onto an array of eight FlexRAM storage units through a software-and-hardware setup. This array is equivalent to 1 byte of data information. The digital signal from the computer was converted into an analog one using pulse-width modulation to precisely control the oxidation and reduction of the liquid metal.

- **Side note, what is pulse-width modulation?** [Pulse-width modulation](#) is a method of controlling the average power or amplitude delivered by an electrical signal.
- The gallium-based liquid metal droplets are encased in Ecoflex, a stretchable biopolymer. The researchers used a 3D printer to create Ecoflex molds and injected the gallium-based liquid metal droplets and a solution of polyvinyl acetate hydrogel separately into the cavities in the mold. This process increases the device's resistance ratio and prevents solution leakage.
- The current prototype is a volatile memory but has shown the ability to retain data for up to 12 hours even when the power is switched off. This feature, combined with its stable performance for over 3,500 cycles of operation, suggests that FlexRAM could be developed into different forms of memory.
- The liquid metal RAM also demonstrated impressive stability, even under extreme deformations such as 100% stretching, 180° bending, and 360° twisting. This resilience hints at exciting possibilities for its use in future soft intelligent robots, brain-machine interface systems, and wearable/implantable electronics.

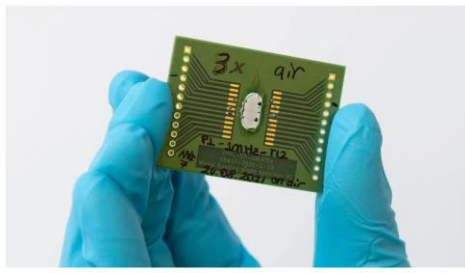


Story 2: Scientists turn glass into a 'transparent' semiconductor with laser

Source: InterestingEngineering.com

Story by Rizwan Choudhury

Link: <https://interestingengineering.com/innovation/scientist-turn-glass-into-a-transparent-semiconductor-with-laser>



- A team of scientists from the [Swiss Federal Institute of Technology Lausanne](#) and [Tokyo Institute of Technology](#) discovered that they could turn ordinary glass

into a light-powered semiconductor using a femtosecond laser, a significant breakthrough in material science. The research, published in [Physical Review Applied](#), has opened up new possibilities for various applications, such as smart windows and sensors.

- **Side note, what is a femtosecond laser?** A femtosecond laser is one that emits optical pulses with a duration of a femtosecond. A femtosecond is ultra short, being *one quadrillionth* of a second.
 - **Note:** A quadrillion is equal to 1,000 trillions, or 1,000,000 billions!
- The scientists were interested in the behavior of atoms in tellurite glass, which contains tellurium when exposed to ultrafast pulses of high-energy laser light. They were surprised to discover that the laser created tiny crystals of tellurium and tellurium oxide, both semiconducting materials, inside the glass, precisely where the light hit. This finding implies that the glass could generate electricity when exposed to daylight.
 - **Side note, what is tellurium?** Tellurium is a very brittle, non-malleable, silvery white metalloid.
 - **Side note, what is tellurite glass?** Tellurite glass, distinct from silica-based glasses, is a fascinating material with unique properties. It contains the element tellurium, which is positioned two elements down and two elements over from silicon on the [periodic table](#).

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18													
Period	1	2																													
Nonmetals	1	1 H																													
	2	3 Li	4 Be															5 B	6 C	7 N	8 O	9 F	10 Ne								
Metals	3	11 Na	12 Mg													13 Al	14 Si	15 P	16 S	17 Cl	18 Ar										
	4	19 K	20 Ca													21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
	5	37 Rb	38 Sr													39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
	6	55 Cs	56 Ba	La to Yb	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn											
	7	87 Fr	88 Ra	Ac to No	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg	112 Cn	113 Nh	114 Fl	115 Mc	116 Lv	117 Ts	118 Og											
		s-block (incl. He)		f-block		d-block										p-block (excl. He)															
						Transition metals (sometimes excl. group 12)																Some elements near the dashed staircase are sometimes called metalloids		Noble gases							

- The team was thrilled with this discovery and saw the potential for creating durable patterns on the glass surface that could produce electricity when illuminated. This is a significant breakthrough because the technique does not require any additional materials, and all that is needed is tellurite glass and a femtosecond laser to create an active photoconductive material.
 - **Side note** – [typical cost for a femtosecond laser](#) is approximately \$400k to \$500k.
- The Swiss Federal Institute of Technology Lausanne team used tellurite glass provided by their collaborators at Tokyo Institute of Technology and applied their expertise in femtosecond laser technology to modify the glass and study the effect of the laser.
- They discovered that by drawing a simple line pattern on the surface of a tellurite glass disc 1 cm in diameter, they could create a device that could generate a current when exposed to UV light and the visible spectrum, which could last for months without degradation.
- The potential of this discovery is enormous, and it could revolutionize how we use glass in our daily lives. This new technique could develop smart windows that can generate electricity and other applications.



Story 3: Europe's deepest mine to become giant gravity battery

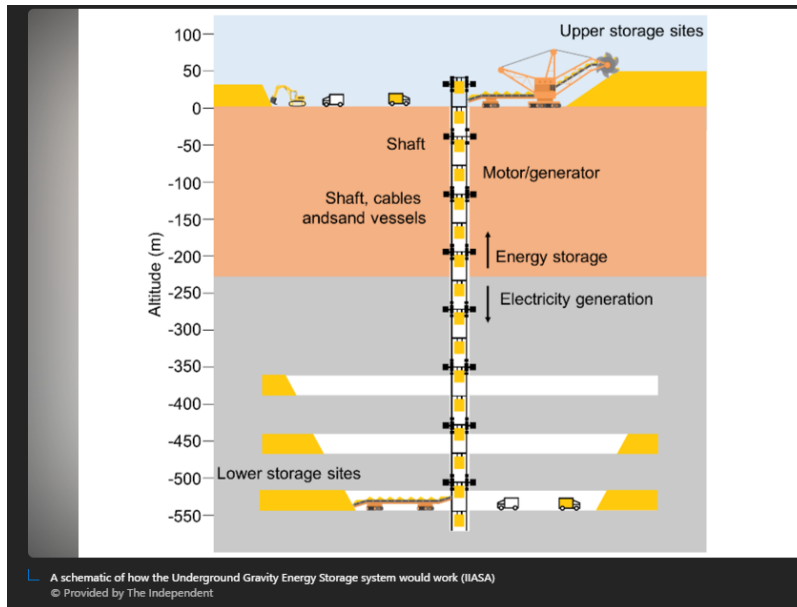
Source: The Independent via MSN

Story by Anthony Cuthbertson

Link: <https://www.msn.com/en-us/news/technology/europe-s-deepest-mine-to-become-giant-gravity-battery/ar-BB1hVJxb>

Source: Euronews.com

Link: <https://www.euronews.com/green/2024/02/06/this-disused-mine-in-finland-is-being-turned-into-a-gravity-battery-to-store-renewable-ene>



- An abandoned mine in Finland is set to be transformed into a giant battery to store renewable energy during periods of excess production.
- The [Pyhäsalmi Mine](#), roughly 450 kilometers north of Helsinki, is Europe's deepest zinc and copper mine and holds the potential to store up to 2 megawatts of energy within its 1,400-meter-deep shafts [4,600 feet].
- The gravity battery system has been developed by Scottish firm [Gravitricity](#), which plans to use the Finnish mine as a full-scale prototype to demonstrate the technology.
- What is a gravity battery, and how does it work?
 - [First a definition](#) – A gravity battery is a type of electricity storage device that stores gravitational energy, the energy stored in an object resulting from a change in height due to gravity, also called potential energy.

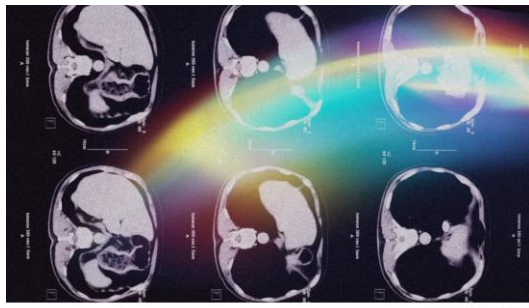
- A gravity battery works by using excess energy (usually from sustainable sources) to raise a mass [i.e. a weight] to generate gravitational potential energy, which is then lowered to convert potential energy into electricity through an electric generator.
- One form of a gravity battery is one that lowers a mass, such as a block of concrete, to generate electricity. The most common gravity battery is used in pumped-storage hydroelectricity, where water is pumped to higher elevations to store energy and released through water turbines to generate electricity. See tutorial video here: <https://www.youtube.com/watch?v=kuVjkL9XYVI>
- **For this prototype in Finland** -- When there is excess power - from wind turbines on a windy day for example - weights would be winched up the Pyhäsalmi mine's 530-meter auxiliary shaft.
- To generate energy these weights can be released. This turns the winches into generators, creating either a short burst of electricity or a slower trickle depending on what is needed.
- Scientists from the [International Institute for Applied Systems Analysis](#) found that the world's abandoned mine shafts could store up to 70 terawatt hours of power - roughly the equivalent of global daily electricity consumption.
- The International Institute for Applied Systems Analysis analysts also noted that mines already have the basic infrastructure for such an endeavour, while also being connected to the power grid. *"This significantly reduces the cost and facilities for the implementation of Underground Gravity Energy Storage plants."*

Story 4: A new AI-based risk prediction system could help catch deadly pancreatic cancer cases earlier

Source: Technologyreview.com

Story by Rhiannon Williams

Link: <https://www.technologyreview.com/2024/01/17/1086730/a-new-ai-based-risk-prediction-system-could-help-catch-deadly-pancreatic-cancer-cases-earlier/>



- Pancreatic cancer is a difficult disease to detect. The pancreas itself is hidden by other organs in the abdomen, making it tough to spot tumors during tests. Patients also rarely experience symptoms in the early stages, meaning that the majority of cases are diagnosed at an advanced stage—once it's already spread to other parts of the body. This makes it much harder to cure.
- As a result, it's essential to try to catch pancreatic cancer at the earliest stage possible.
- A team of researchers from [MIT's Computer Science and Artificial Intelligence Laboratory](#) worked with [Limor Appelbaum](#), a staff scientist in the department of radiation oncology at the [Beth Israel Deaconess Medical Center in Boston](#), to develop an AI system that predicts a patient's likelihood of developing pancreatic ductal adenocarcinoma (PDAC), the most common form of the cancer.
- The system outperformed current diagnostic standards and could someday be used in a clinical setting to identify patients who could benefit from early screening or testing, helping catch the disease earlier and save lives. The research was published in the journal [eBioMedicine](#) [i.e. December 2023].
- The researchers' goal was to create a model capable of predicting a patient's risk of being diagnosed with pancreatic cancer the next six to 18 months, making early-stage detection and cure more likely. To develop it, they examined existing electronic health records.
- The resulting system, known as PRISM, consists of two AI models.
 - The first uses artificial neural networks to spot patterns in the data, which include patients' ages, medical history, and lab results. It then calculates a risk score for an individual patient.

- The second AI model was fed the same data to generate a score but used a simpler algorithm.
- The researchers fed the two models anonymous data from 6 million electronic health records, 35,387 of which were pancreatic cancer cases, from 55 health-care organizations in the US.
- The team used the models to evaluate patients' pancreatic cancer risk every 90 days until there was no more sufficient data or the patient was diagnosed with pancreatic cancer. They followed up on all enrolled patients from six months after their first risk evaluation until 18 months after their last risk evaluation to see if they were diagnosed with pancreatic cancer in that time.
- Among people who developed pancreatic cancer, the neural network identified 35% of them as high risk six to 18 months before their diagnosis, which the authors say is a significant improvement over current screening systems.



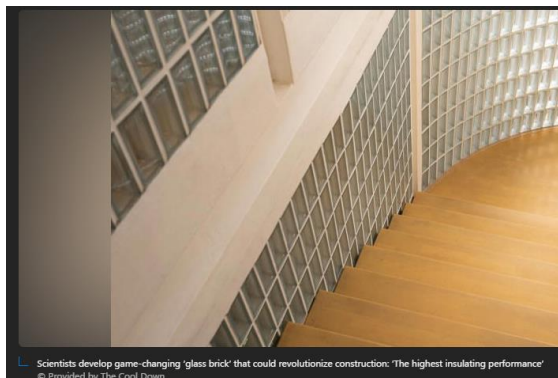
Honorable Mentions:

Story: Scientists develop game-changing 'glass brick' that could revolutionize construction: 'The highest insulating performance'

Source: The Cool Down

Story by Doric Sam

Link: <https://www.msn.com/en-us/lifestyle/lifestyle-buzz/scientists-develop-game-changing-glass-brick-that-could-revolutionize-construction-the-highest-insulating-performance/ar-BB1i0vZW>



Scientists develop game-changing 'glass brick' that could revolutionize construction: 'The highest insulating performance'
© Provided by The Cool Down

- A team of Swiss scientists has developed a new construction material that could be a game-changer thanks to its insulation abilities.
- As explained in [Sci.News](#), a team of materials scientists from Empa (Swiss Federal Laboratory for Science and Technology) and the Slovak University of Technology has found a way to reduce lighting and heating, ventilation, and air conditioning (HVAC) energy demands without having to increase the thickness of the insulation layer.
- By using silica aerogel granules, the scientists created an aerogel glass brick, which is a translucent and thermally insulating material. Not only is it a highly attractive solution that would improve visual comfort, but it would also help save heating costs by increasing solar gains and reducing the use of artificial light.
- “This is the highest insulating performance of any brick found in the technical literature, let alone on the market. Additionally, it comes with the property of light transmission,” Empa researcher Jannis Wernery and his colleagues stated. “The aerogel glass brick is suitable for applications in which there are simultaneous requirements for high daylight penetration, glare protection, and privacy protection, such as in offices, libraries, and museums.”

Story: Tech review: Flexible solar panel is thin, light, and tough and it is easy to mount

Source: Tribune News Service via MSN

Story by Jim Rossman

Link: <https://www.msn.com/en-us/money/other/tech-review-flexible-solar-panel-is-thin-light-and-tough-and-it-is-easy-to-mount/ar-BB1hW14w>



- The BougeRV Yuma 100 watt CIGS Thin Film flexible solar panel with tape (\$279.99, <https://shrsl.com/4e2bh>) got my attention immediately because it was so light and flexible. It comes in a box rolled up, about the size of a yoga mat.
- The panel measures 26 inches by 44 inches and it weighs just 4.3 pounds, and it is IP68 waterproof.
- BougeRV sells a few versions of the Yuma panel. There are also 200W versions available.

Story: Engineers fashion strands of conductive fiber that can be woven into clothes

Source: TechXplore.com

Story by Bob Yirka

Link: <https://techxplore.com/news/2024-02-fashion-strands-fiber-woven.html>



- A team of engineers affiliated with a host of institutions in China and two in Singapore has developed a type of conductive fiber that can be woven into clothes to give them smart device capabilities. The study is published in Nature. Xiaoting Jia and Alex Parrott from Virginia Tech have published a News & Views piece in the same journal issue, outlining the work by the team on this new effort.
- The team began by first studying the properties of current semiconductor-based fibers designed for use in fabrics to find where the flaws lay. They then looked at other technology, such as glass used to make smartphone screens, to learn how to make glass that does not crack under duress. They created and tested a

variety of fibers until they found one that passed all their tests. Making it involved first creating a semiconducting wire using silicon and then covering it with melted glass as it was pulled into a strand. The glass was then etched away and the wire covered with a stretchable and bendable polymer coating.

- Testing showed that the resulting fiber could be stretched and bent in ways suitable for use in clothing. It could also be woven into existing fabrics, such as cotton, while maintaining its conductive abilities. The researchers made several products using their fiber, including a hat with the ability to sense traffic light colors and a wrist strap that monitors a wearer's heart rate. They also found that each of the test products continued to work as designed even after six months of use and washing.