



SPARC WEEKLY



NEW PLASTIC MATERIAL FULLY DEGRADES IN THE OCEAN



Scientists have developed an alternative to plastics that won't pollute the oceans. This new material is as strong and durable as conventional plastics, with one key difference — it fully dissolves in seawater, leaving behind molecules that can be eaten by microorganisms.

“I really wanted to develop new plastics that can potentially address these critical issues (like sea pollution), particularly, those that do not form microplastics in oceans.” said Takuzo Aida, professor at the University of Tokyo and deputy director of the RIKEN Center for Emergent Matter Science.

However, because of the reversible nature of their chemical bonds, this type of materials are typically weak and unstable compared to the plastics we use in our everyday life. Aida and colleagues were able to overcome this challenge by designing a new material with chemical bonds that are only reversible when in contact with seawater — under any other conditions, they behave as a traditional plastic. The researchers created these new plastics by combining two molecular building blocks. When brought together in water, these molecules spontaneously form a reversible type of bond between them, known as a salt bridge. This would result in salt being released into the water, which could then be removed to leave behind a strong, durable material.

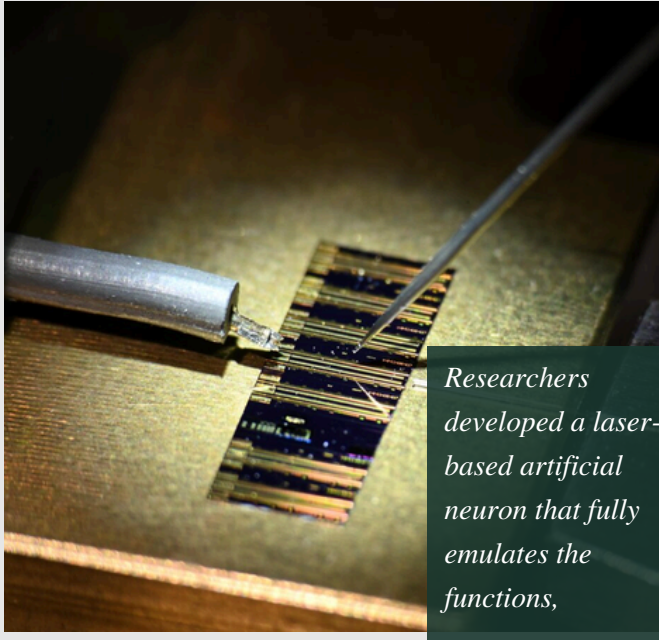
Depending on the application, these materials could be made stronger, more flexible, scratch-resistant, or rubbery. For instance, one of the versions the researchers created was designed to be used in 3D printing.

“Our new plastic materials can be widely utilized for an occasion where mechanically hard lightweight materials are required,” said Aida.

Going forward, Aida and colleagues intend to continue developing new versions of these plastics that cover a wider range of applications.

<https://www.advancedsciencenews.com/new-plastic-material-fully-degrades-in-the-ocean/>

LASER-BASED ARTIFICIAL NEURON MIMICS NERVE CELL FUNCTIONS AT LIGHTNING SPEED



Researchers developed a laser-based artificial neuron that fully emulates the functions,

Researchers have developed a laser-based artificial neuron that fully emulates the functions, dynamics and information processing of a biological graded neuron. With a signal processing speed of 10 GBaud -- a billion times faster than its biological counterparts -- the new laser graded neuron could lead to breakthroughs in fields like artificial intelligence and other types of advanced computing.

"By leveraging its neuron-like nonlinear dynamics and fast processing, we built a reservoir computing system that demonstrates exceptional performance in AI tasks such as pattern recognition and sequence prediction." said research team leader Chaoran Huang from the Chinese University of Hong Kong.

"Our technology could accelerate AI decision-making in time-critical applications while maintaining high accuracy," said Huang. "We hope the integration of our technology into edge computing devices -- which process data near its source -- will facilitate faster and smarter AI systems that better serve real-world applications with reduced energy consumption in the future."

Laser-based artificial neurons, which can respond to input signals in a way that mimics the behavior of biological neurons, are being explored as a way to significantly enhance computing thanks to their ultrafast data processing speeds and low energy consumption. However, most of the ones developed so far have been photonic spiking neurons. These artificial neurons have a limited response speed, can suffer from information loss and require additional laser sources and modulators. For the laser graded neuron, the researchers used a different approach by injecting radio frequency signals into the quantum dot laser's saturable absorption section, which avoids this delay. They also designed high-speed radio frequency pads for the saturable absorption section to produce a faster, simpler and more energy-efficient system.

"In this work, we used a single laser graded neuron, but we believe that cascading multiple laser graded neurons will further unlock their potential. We are working to improve the processing speed of our laser graded neuron while also developing a deep reservoir computing architecture that incorporates cascaded laser graded neurons." said Huang

<https://www.sciencedaily.com/releases/2024/12/241219152223.htm>

<https://techxplore.com/news/2024-12-laser-based-artificial-neuron-mimics.html>

“MIRROR BACTERIA” WARNING: A NEW KIND OF LIFE COULD POSE A GLOBAL THREAT

“Mirror life/ bacteria” refers to synthetic organisms with molecular structures reversed from those found in natural life. At first glance, creating such life forms seems impossible—and for now, it is. Even the simplest mirror bacterium would be far too complex for scientists to build with current technology.

However, the idea of mirror life may not remain purely theoretical. But they could also pose serious environmental risks, behaving in unpredictable and potentially harmful ways. Michael Kay, MD, PhD, a biochemistry professor at the Spencer Fox Eccles School of Medicine at the University of Utah and an expert in mirror-image pharmaceuticals, explains the science behind mirror life—and why he believes it should remain hypothetical.

“When we’re talking about mirror-image life, it’s kind of like a “what if” experiment: What if we constructed life with right-handed proteins instead of left-handed proteins? Something that would be very, very similar to natural life, but doesn’t exist in nature. We call this mirror-image life or mirror life. This type of life would only exist if it was made synthetically”.



*Mirror life
presents serious
dangers.*

“Interest is largely in mirror-image therapeutics. If you give therapeutics to a person, especially protein or nucleic acid therapeutics, digestive enzymes in the body break them down rapidly, sometimes within minutes. This can make it very challenging to treat chronic illnesses in a way that’s cost-effective and convenient. But mirror molecules are not recognized by those digestive enzymes, so they have the potential to last for a much longer period of time and to open up a whole new class of therapeutics that would allow us to treat a variety of diseases that are currently challenging.”

“However, a mirror organism would interact with the rest of our world in unpredictable, uncertain ways. There is a plausible threat that mirror life could replicate unchecked, because it would be unlikely to be controlled by any of the natural mechanisms that prevent bacteria from overgrowing. There’s a lot of uncertainty in this determination. At this point, we don’t have enough information to make a definitive estimate of what the risk would be.”

<https://scitechdaily.com/mirror-bacteria-warning-a-new-kind-of-life-could-pose-a-global-threat/>

SCIENTISTS DISCOVER EXPLANATION FOR THE UNUSUALLY SUDDEN TEMPERATURE RISE IN 2023



Rising sea levels, melting glaciers, and marine heatwaves—2023 broke numerous alarming records. Among them, the global mean temperature climbed to nearly 1.5°C above preindustrial levels, marking an unprecedented high. Researchers face a significant challenge in pinpointing the causes of this sudden spike. While factors such as human-driven greenhouse gas accumulation, the El Niño weather phenomenon, and natural events like volcanic eruptions explain much of the warming, they don't fully account for it. Notably, there remains an unexplained gap of about 0.2°C in the global temperature rise. A team from the Alfred Wegener Institute proposes a compelling hypothesis: the Earth's surface has become less reflective due to a decline in certain types of clouds. This reduction in reflectivity may help explain the additional warming.

“What caught our eye was that, in both the NASA and ECMWF datasets, 2023 stood out as the year with the lowest planetary albedo,” says co-author Dr Thomas Rackow from the ECMWF. Planetary albedo describes the percentage of incoming solar radiation that is reflected back into space after all interactions with the atmosphere and the surface of the Earth. “We had already observed a slight decline in recent years. The data indicates that in 2023, the planetary albedo may have been at its lowest since at least 1940.” This would worsen global warming and could explain the ‘missing’ 0.2 degrees Celsius. But what caused this near-record drop in planetary albedo?

One trend appears to have significantly affected the reduced planetary albedo: the decline in low-altitude clouds in the northern mid-latitudes and the tropics. The fact that mainly low clouds and not higher-altitude clouds are responsible for the reduced albedo has important consequences. Clouds at all altitudes reflect sunlight, producing a cooling effect. But clouds in high, cold atmospheric layers also produce a warming effect because they keep the warmth emitted from the surface in the atmosphere. “Essentially it's the same effect as greenhouse gases,” says Helge Goessling. But lower clouds don't have the same effect. “If there are fewer low clouds, we only lose the cooling effect, making things warmer. Yet Helge Goessling considers global warming itself is reducing the number of low clouds. “If a large part of the decline in albedo is indeed due to feedbacks between global warming and low clouds, as some climate models indicate, we should expect rather intense warming in the future,” he stresses.

<https://scitechdaily.com/scientists-discover-explanation-for-the-unusually-sudden-temperature-rise-in-2023/>

WHO ARE WE?

SPARC Robotics Team's mission and vision is to make our environment the best it can be. On a volunteer basis, we look at the problems that are happening around us and make them our problems, both as SPARC and individually, and help as much as we can with appropriate projects. NASA ACCP (Astro Camp Community Partners) was only in the US until four years ago. This year they came to Turkey with us after four years of traveling to many countries. ACCP educates school-age children from kindergarten to high school on science-related topics of interest with practical knowledge and application, while also supporting children's craft development, general culture and questioning skills. As SPARC, we have brought this training provided by NASA to our country in the most comprehensive way and our continuous communication with NASA not only enables us to improve our trainings day by day, but also gives us the opportunity to learn about the innovations in the field of STEM instantly, from the most accurate source and to spread the knowledge we have around us.



EDITOR

Dear reader,

Greetings from SPARC Weekly, in which we gather latest scientific news.

We would be delighted to hear your comments or suggestions and we encourage you to write to us if you have any views or opinions on the stories in SPARC Weekly. We look forward to hearing from you. Have a nice week and enjoy the magazine.

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