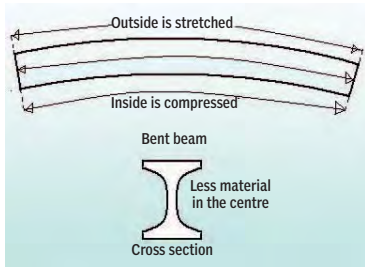


Mega strength in nano materials

THERE IS MORE GRIT TO THE GRAM IN MINERALS FOUND IN NATURE, SAYS S ANANTHANARAYAN

Microscopic organisms found in the sea build themselves lightweight, mineral frameworks that support the bulk of the organism. Radiolarians are single-cell creatures, less than a fifth of a millimetre across, found in zooplankton, and they have an intricate mineral skeleton. Diatoms are microscopic, sometimes single-cell creatures that have a shell made of silica, or the material of sand. Sponges are multi-cell animals that consist of a porous network of the material of fibrous tissue.



the outer parts of the length of the beam that are compressed or stretched. Hence, a beam can be equally strong even if material in the middle is removed — which leads to the cross section of beams used in engineering.

Strength and dimensions

One element in efficient framework structures is that all parts of the cross section of a support are not equally important. When a beam is bent, for instance, it is the inner or



Julia R Greer.

This apart, when objects become smaller, the cross section of supports can shrink faster than the dimensions of the object, because the weight to be supported depends on the cube of the dimensions while the strength of the supports depends only on the square.

But in the case of natural skeletons of micro-organisms, it is found that the ratio of mechanical strength to weight, of the support, is better than what it should be, simply based on the dimensions and the bulk properties of the materials.

Copying nature

In their study, the California scientists used this idea, by first finding out the dimensions at which different materials began to show improved properties. Then, they created three-dimensional structures, using members of the materials, of the appropriate sizes.



Both images are the same size. The legs of the fly are proportionately thinner.



Shell structure in different diatom species.



Images of synthetic lattice made from TiN.

form of single crystals; second, there should be a technique to fabricate the components at these reduced sizes; and, third, it should be possible to create a larger structure out of these smaller modules.

The team was able to do all this with the ceramic material titanium nitride (TiN). The team first digitally created a three-dimensional structure similar to that of the diatom shell. The structure was then built up of TiN, using twin methods, called Two Photon Lithography and Atomic Layer Deposition.

TiN is then deposited, using ALD, which is a

chemical vapour deposition technique where atom layer control is possible. Etching out the polymer material then leaves a lattice of thin and hollow nanotubes. The struts in the lattice can be about seven microns long, of tubes with wall thickness 75 nanometres, which is 0.075 microns.

Testing the structure that was created with a varying load showed that the material displayed good stiffness and uniform bending till about 80 per cent of its maximum strength and then became non-uniform and failed at a load of about 150 micro Newtons.

Its size of the structure created is a one-millimetre cube. The test results suggest that the fabrication technique developed could be used to build lightweight, robust components and devices.

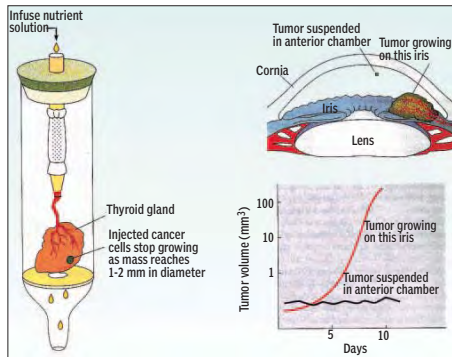
"With this approach, we can really start thinking about designing materials backward," says Julia R Greer, professor at Caltech. "I can start with a property and say that I want something that has this strength or this thermal conductivity, for example. Then I can design the optimal architecture with the optimal material at the relevant size and end up with the material I wanted... We are now able to design exactly the structure that we want to replicate and then process it in such a way that it's made out of almost any material class we'd like — for example, metals, ceramics, or semiconductors — at the right dimensions."

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CANCER AND HOW IT SPREADS

TAPAN KUMAR MAITRA EXPLAINS WHY ~ GIVEN THE VAST NUMBER OF ACTIVITIES THAT NEED TO BE COORDINATED IN EVERY CELL ~ MALFUNCTIONS OCCASIONALLY ARISE

Anyone familiar with events occurring inside living cells must feel a sense of awe at the complexities involved. Given the vast number of activities that need to be coordinated in every cell, it is not surprising that malfunctions occasionally arise. Cancer is a prominent example of a disease that arises from such abnormalities in cell function.



Cancer cells (left) were injected into an isolated rabbit thyroid gland that was kept alive by pumping a nutrient solution into its main blood vessel. The tumor cells fail to link up to the organ's blood vessels and the tumor mass stops growing when it reaches a diameter of roughly one-two millimetres.

most investigators initially believed these were either pre-existing vessels that had expanded in response to the tumor's presence or were part of an inflammatory response designed to defend the host against the tumor.

This idea was initially based on observations involving cancer cells grown in isolated organs under artificial laboratory conditions. In one experiment, a normal thyroid gland was removed from a rabbit and placed in a glass chamber, a small number of cancer cells were injected into the gland and a nutrient solution was pumped into the organ to keep it alive.

When tumor cells were removed from the thyroid gland and injected back into animals, cell proliferation resumed and massive tumors developed. Why did the tumors stop growing at a tiny size in the isolated thyroid gland and yet grow in an unrestrained fashion in live animals?

the tumors needed a blood supply to grow beyond a tiny mass.

If tumors require blood vessels to sustain their growth, how do they ensure this need is met? The first hint came from studies in which cancer cells were placed inside a chamber surrounded by a filter possessing tiny pores through which cells cannot pass.

Subsequent investigations have revealed that the main angiogenesis-activating molecules are proteins called Vascular Endothelial Growth Factor and Fibroblast Growth Factor, both of which are produced by many kinds of cancer cells as also certain types of normal cells.

These break down components of the extracellular matrix, thereby permitting the endothelial cells to migrate into the surrounding tissues, the proliferating endothelial cells become organised into hollow tubes that evolve into new networks of blood vessels.

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Wireless innovations

CHENDA KUN REPORTS ON HOW A GROUP OF CAMBODIAN STUDENTS HAS CREATED BLUETOOTH-CONTROLLED ROBOTS AND HOUSEHOLD ELECTRONICS VIA SMARTPHONES

Boxer Muhammad Ali once claimed he was so fast he could turn off a light switch in his hotel room and could jump into bed before the room was dark. That said, you could be even faster thanks to wireless technology created by a group of technology students in Cambodia.

Comprising students and graduates from the Institute of Technology of Cambodia, the team's aim is to design this technology in such a way so that it can be used by all and sundry.

"If you have an Android phone, you can control lighting appliances and other electronics in your house without spending too much time," said Tep Sophatra, a team member and fourth-year student at ITC.

"The reason why we came up with this is because phone technology has become advanced and everyone has access to it," said Yim Bunchhat, team leader. Due to the rapid growth in modern technology, a variety of applications could be controlled by smartphones, thanks to bluetooth communication, he added.



Wall-E, sits happily on a high shelf. Even though the group receives no funding for their projects, there's no doubt these unassuming youngsters are an avid lot.

While most of the equipment they used to make the robot was bought in Cambodia, some parts comprise household electronic items. Sophatra said World-E had been designed to pick up rubbish and she hadn't grown tired of making robots ever since she joined ArrowDot, despite her busy schedule.

ArrowDot hopes to change that. "If our country has no technology, then it seems we live in an era where people know nothing. How can we catch up with others who have already been to the moon? With this technology, we can strengthen and raise the profile of our country," said Bunchhat.

Asked how this technology would benefit consumers if investments were made in projects like Magic House, he said it would save money and time.

PLUS POINTS

'Mangrove management is a necessity'

The prevailing idea that sea-level rise will inevitably wipe out mangrove forests — fragile ecosystems that protect nearby communities from natural hazards such as floods and storms — is challenged by a recent "Response of mangrove soil surface elevation to sea level rise" report.

Activities such as building dams on rivers and converting mangrove areas into shrimp farms may have a stronger impact on the health of these eco-systems than sea-level rise, it adds.

"A lot of the rivers (that feed mangrove areas) are being dammed, and by doing that we reduce the freshwater and sediment flow to mangroves. Both can be very deleterious," said Anna McIvor, lead author of the report and a researcher at the University of



Cambridge, UK. "Once mangroves are degraded, they are much less likely to keep up with sea-level rise," she said.

Alfredo Quarto, executive director of the Mangrove Action Project, a US conservation NGO, said the report's main benefits were that it highlighted the need for further study and the need to act. "One of the problems with such studies," he said, "is that (though) they highlight things that are important, how does one take those bits of information and put them into practice to conserve the mangroves? So I hope the report stimulates action by governments and that they see the value of mangroves in protecting (communities)."

sciidev.net

Sniffing danger

An "artificial nose" that could save lives by swiftly sniffing out blood-poisoning bacteria has been developed by scientists. The device can test for the bugs in just 24 hours instead of the usual 72 and researchers hope it can be used to prevent sepsis, a potentially fatal condition. In some cases it can



Researchers hope that the artificial nose will be used to prevent sepsis which kills an estimated 20 to 35 per cent of sufferers

rapidly lead to septic shock, organ failure and death. An estimated 20 to 35 per cent of victims die.

The new device consists of a small plastic bottle with a chemical-sensing array or artificial nose attached to the inside. A blood sample is injected into the bottle, which is then shaken to agitate a nutrient solution and encourage bacteria to grow.

Iron Age massacre

Excavations in Somerset have revealed a gruesome glimpse of Iron-Age Britain. Archaeologists have discovered evidence of a massacre involving hundreds, if not thousands of people, with some of the slaughtered bodies being stripped of their flesh or chopped up.

Human remains unearthed from an ancient site near Yeovil have cut marks, often in multiple rows, and occurring at the ends of important joints. "It is as if they were trying to separate pieces of the body", according to Dr Marcus Brittain, the Cambridge archaeologist and head of a major excavation of Britain's largest Iron-Age hill fort, Ham Hill.

Defleshing signs had been found on other Iron-Age human remains, but the scale of the evidence at this site was particularly dramatic, he said. Ham Hill is so vast — the size of 123 football pitches surrounded by Iron-Age ramparts — that only a small part has so far been excavated.

DALYA ALBERGE/THE INDEPENDENT