ARBITit happens here...

#SMART-MATERIAL

Warm Or Cool Buildings

As global warming causes increasingly frequent extreme weather events and variable weather, there is a need for buildings to be able to adapt; few climates require yearround heating or year-round air conditioning.





colour-and much heat it absorbs or emits-based on the outside temperature. On hot days, the material

can emit up to 92% of the infrared heat it contains, helping cool the inside of a build ing. On colder days, however, the material emits just 7% of its infrared, helping keep a building warm.

"We've essentially figured out a low-energy way to treat a building like a person; you add a layer when you're cold and take off a layer when vou're hot." savs assistant professor Po-Chun Hsu of the University of Chicago's Pritzker School of Molecular Engineering (PME)

"This kind of smart material lets us maintain the temperature in a building without huge amounts of energy." According to some esti mates, buildings account for 30% of global energy consumption and emit 10% of all global greenhouse gas. About half of this energy footprint is attributed to the heating and cooling of interior



"For a long time, most of us have taken our indoor temperature control for granted, without thinking about how much energy it requires,' says Hsu, who led the research published in Nature Sustainability. "If we want a carbon-negative future. I think we have to consider diverse ways to control building temperature in a more energy-efficient way.

Researchers have previous ly developed radiative cooling materials that help keep buildings cool by boosting their ability to emit infrared, the invisible heat that radiates from people and objects. Materials also exist that prevent the emission of infrared in cold climates.

"A simple way to think about it is that if you have a completely black building facing the sun, it's going to heat up more easily than other buildings," says graduate student Chenxi Sui, the first author of the paper.

That kind of passive heating might be a good thing in the winter, but not in the sum-

chameleon-like building material changes its infrared how

As global warming causes increasingly frequent extreme weather events and variable weather, there is a need for buildings to be able to adapt: few climates require vear-round heating or vearound air conditioning.

Hsu and colleagues designed a non-flammable "electrochromic" building material that contains a lave that can take on two conformations: solid copper that retains most infrared heat, or a watery solution that emits infrared. At any chosen trigger temperature, the device can use a tiny amount of electricity to induce the chemical shift between the states by either depositing copper into a thin film, or stripping that

copper off. In the new paper, the researchers detailed how the device can switch rapidly and reversibly between the metal and liquid states. They showed that the ability to switch between the two conformations remained efficient

even after 1.800 cycles. Then, the team created models of how their material could cut energy costs in typical buildings in 15 different US cities. In an average commercial building, they reported, the electricity used to electrochromic induce changes in the material would be less than 0.2% of the total electricity usage of the buildng, but could save 8.4% of the building's annual HVAC energy consumption.

"Once you switch between states, you don't need to apply anv more energy to stav in either state." savs Hsu. "So for buildings where you don't need to switch between these states very frequently, it's really using a very negligible amount of electricity."

So far, Hsu's group has only created pieces of the materia that measure about six centimetres across. However, they imagine that many such patches of the material could be assembled like shingles into larger sheets. They say the material could also be tweaked to use different. custom colours-the watery phase is transparent and nearly any colour can be put behind it without affecting its ability to absorb infrared.

The researchers are now investigating different ways of fabricating the material They also plan to probe how intermediate states of the material could be useful.

"We demonstrated that radiative control can play a role in controlling a wide range of building temperatures throughout different seasons," says Hsu. "We're continuing to work with engineers and the building sector to look into how this can contribute to a more sustainable future.'



Earning Two Jeeps For The Reserve (...2)

Tiger was in our clear view and Ramprasad indicated to stop the jeep here for sake of viewing it with safety, but provoked by Mr Opa's rhetoric, I was tempted togive him a shocking treatment this time. And I carried on till the annoved tiger stopped me emitting a low growl for breaching the flight distance rule. We were hardly fifteen feet from the tiger, a huge one with fresh blood smeared on its face. The tiger had continued its low growl with bristles erected on the sides of its mouth. Ramprasad asked me to pull back but instead I in the rage switched off the engine which brought the animal in crouching posture. It was quite scary to every one of us and utmost to Mr Opa who was closest to the tiger that minute.



#WILD LIFE

labour and effort goes waste. The

Sun was yet to set and animals were

on their usual routine and even the

had arranged a cup of tea at the research centre cum camping site Kalighati, located in the heart of the reserve, a wonderful site for wilderness enthusiasts. Here in the lap of the nature at its best everybody was more than happy but

for Mr Opa. It was bit irritating for me who had gone all out to make his trip memorable. Reading my face Ashok ji pulling me to a corner, again reiterated that not only replacement case of our vehicles but number of other projects of great wildlife interest are lying with this officer.

He was motivating me to tolerate him a little more lest our entire



connecting the verandah, we were sitting, facing the motor track. Changing my mood with effort, I invited everybody to board the open jeep once again to embark upon the journey to explore even deeper forest in the hope of witnessing what nature had for us This time I took the Governor road, a motorable track made long back to extract bamboo from the

block behind the Kalighati tower and afterwards developed for the visit of the then governor of Rajasthan. This track cut through a dense forested hill is full of twists and turns. The drive on this section offers not only thrill and excitement of passing through a dense bamboo forest but also a rare opportunity to enjoy sighting of some rare

pheasants and



herds of chital, sambar with troops of langoors. It runs along an important nullah thus hosts a large variety of wild animals. It is a heaven or large cats who also use its secluded pockets for siesta except during extreme winters.

Lucky Trip

I recall the visit of the celebrity Saxena brothers, the two former top bureaucrats of India. Naresh Chandra was not only former Chief Secretary of Rajasthan but also on that date was the Senior Advisor to Shri Narsimha Rao, the then Hon'ble Prime Minister of India where his elder brother Girish Chandra ji had been Governor of J&K, the super sensitive state of the country since its inception. They with family were being escorted by 'Y+' category security. They got packed in one gypsy, albeit with difficulty with me on the steering wheel. While enjoying ride through this Governor road, some of these members fell off more than once in the vehicle yet took it sportingly and enjoyed this too. After the visit Shri Naresh Chandra ji conveyed high appreciation to us, issuing an official letter. I was taking the Additional Secretary, much junior to the Saxena brothers duo, this

time to give him the

unique

same

viding desirable opportunity of hunting to this crepuscular, in this core tiger territory. Everybody was overioved by this action packed exciting experience but for the sec-By the time we reached the rest house it was already dark. We

enjoyed drinks on bonfire once again. Ashok ji, being a wildlife enthusiast had enjoyed the trip to his hearts' content and genuinely showered praises on our management. This appreciation by the Advisor to the Union Minister meant a lot to me but the game spoiler could not tolerate this and intervened in his typical style slap-

The tiger with a bit louder growl moved further to disappear in the nullah. This close encounter had given goose bumps to all the guests and none exchanged a word till we reached back Sariska. Reaching the rest house Mrs Opa took proper class of her husband for having puzzled us unnecessarily by his rhetoric, 'where are tigers?'

should a reserve like Sariska be most knowledgeable staff about allotted so much of budget when it has no tigers?' I had been tolerating him for two days and now this kind of remark: I lost my head and left the place without taking my food, inspite of Ashok ji's repeated requests. I was pretty upset because of this sad ending of a trip we both wished to make most pleasant for our VIP guest. Next day about seven in the

morning I was sipping tea on my bungalow's terrace opening in the valley full of lush green shrubs and medium sized trees, that the headquarters' wireless incharge rushed to me with the information that at Kalighati waterhole the male tiger had killed a chital and was still absorbed with devouring the kill. He had already informed my driver who had readied the jeep for our visit. Not interested in taking the secretary any more along, I

THE WALL PEOPLE SAY NOTHING IS IMPOSSIBLE BUT \$ 7.8° I DO NOTHING EVERY DAY A.A. MILNE

BABY BLUES



International Vegan Cuisine Month



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egans are conscientious eaters who pay careful attention to their diets-and often to the clothes they wear and other products they buy as well. They remove all animal products from their lives for a variety of reasons. Whether it's because they hope to save the planet by saving the animals or just to feel healthier overall without meat and dairy in their diets, he vegan lifestyle has become an ever-increasing craze for people to learn about and join.

experience. This trip proved luckier than the one with saxena brothers, since this time we sighted a fairly good sized leopard leisurely stretched on a rock, perhaps awaiting the Sun to disappear wholly behind the western side hill, pro-

deceive them as it is a fresh kill and neither there are tall grasses nor thickets close to the kill to provide hide to the tiger; moreover this tiger is not a shy one. But Ashok ji wouldn't listen to me and once again, against my will I had to be on the trip with them. I was on the wheel where the secretary was again in the front seat with me. a forced company to me.

Close Encounter

I remained almost silent through out the journey except replying to Ashok ji in briefest possible words like yes, ok. Shortly we reached ping an irritating question, 'why Kalighati Naka. Ramprasad, the

Sariska forests and in charge of the

Kalighati naka was eagerly await-

ing us here and rode our vehicle in

run. The site was some fifty odd

meters from the naka, by the water

hole. The partially eaten carcass of a male chital was lying there. All

around the carcass were several

pug marks of the tiger which might

have moved from the kill few min-

utes back only probably smelling

some disturbance. Surprisingly there were no alarm calls from any

prev species, indicating the tiger

had stationed itself in some hide.

close by Ramprasad started tracking the animal following its pug

marks where I hurriedly returned

turbance, to lure the tiger to return

back to the kill. Possessed by nega-

tivity Mr Secretary again started

his rhetoric 'why can't this be kill of

a leopard' as the carcass is of just a

back to the vehicle to minimize dis-

The Governor Road Cut Through Dense Bamboo & Misc Forest. instructed him to inform Ashok ji chital and not any large animal like and tell the driver to show tiger to sambar or nilgai'; after all in two the guests. He hurriedly rushed to days jungle visit he had acquired the rest house to comply my orders enough knowledge to beat out any but instead of moving to the site of us who had spent their lives in minutes later Ashok ji reached me the company of these wild creainsisting that I come along. I Already I had enough from him assured him this time tiger can not

in last two days and now again the same. Immediately I reversed the vehicle towards Sariska, when Ramprasad shouted 'Sir. tiger is here only and we will find out with in minutes' but I sped the vehicle. The secretary understanding every thing dared not to ask me to stop a while but Ashok ii won't let me go like this when tiger sighting was almost sure. Within minutes Ramprasad had tracked down the tiger, resting in a dry nullah by the side of the Kundali road track. From close to the spot he waved at me and slowly I moved the jeep and reached close to the possible animal lair taking along Ramprasad in the vehicle.

Tiger was in our clear view and Ramprasad indicated to stop the jeep here for sake of viewing it with safety, but provoked by Mr Opa's rhetoric, I was tempted to give him a shocking treatment this time. And I carried on till the

annoyed tiger stopped me emitting a low growl for breaching the flight listance rule. We were hardly fifteen feet from the tiger, a huge one with fresh blood smeared on its face. The tiger had continued its low growl with bristles erected on the sides of its mouth. Ramprasad asked me to pull back but instead in the rage switched off the engine which brought the animal in crouching posture. It was quite scary to every one of us and utmost to Mr Opa who was closest to the tiger that minute. But panic stricken he was out of wits to ask me the of pulling back avour Understanding the situation Ashok ji tapped my shoulder to pull back and then I switched on the engine that got the tiger on its feet but I pulled back to safe distance keeping an eve on the animal, lest it charges The tiger with a bit louder grow

moved further to disappear in the nullah. This close encounter had given goose bumps to all the guests and none exchanged a word till we reached back Sariska. Reaching the rest house Mrs Opa took proper class of her husband for having puzzled us unnecessarily by his rhetoric, 'where are tigers?' And

asked him if such a close shave has given him enough proof or still he needs more? The Secretary was still numb

Ashok ji, knowing the medicine for the occasion, offered a toast of gin glass. After finishing the drink Mr Opa said, ' I had no doubt right from our first sortie that there are enough tigers as confirmed from the evidences we witnessed now and again but I kept my rhetoric with no ill intention but to put a bit of pressure on you to show us deep er forests and tigers also physically albeit not so closely which was so

Ashok ji, having gulped two drinks in succession, caught the secretary now to discuss the replacement case of the two abandoned vehicles. And brought Mr Opa, pulped adequately by now, to our campus where inspecting the vehicles Mr Opa promised to clear the case at an earliest. For other cases Ashok ji had enough time during journey way back to Delhi. After a fortnight I got the desired financial sanction and thus Sariska got back its lost vehicles. After all tiger had played its magic. Concluded

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WOW

BIG

DECISION





pulations of major pollinators-bees, butterflies, wasps, beetles and others-are diminishing drastically worldwide. And, this rapid decline

of pollinators is alarming and poses a great threat to biodiversiv and food security. These concerns may be allayed soon. Researchers at Tampere University have developed a Dandelion seed-inspired flying robot that can potentially stand in for some of these pollinators.

The Flying Aero-robots based on the Light Responsive Materials Assembly, FAIRY robot, is a tiny lightweight robot that relies on wind to float in the air. Interestingly, the robot can be controlled with a light source such as a laser beam or an LED. This means that the researchers could apply light to the robot to change its shape, allowing it to adapt to the wind's direction This light beam can also be used to control take-off and landing. The study has been published in the journal Advanced Science.

The inability of scientists to make small robots fly despite synthesizing smart materials as good as animal muscles piqued the curiosity of Hao Zeng, the lead author of the research paper. "Looking at the small insects.

butterflies and hovering birds. they have well-defined trajectories for the wing movement. So, flying by wing flapping should be a simple skill to learn. Let's forget about the agility and sophistication in controlling the flight motion, but consider the simplest step in natural flying species flapping the wing to take off, can we reproduce them in inanimate material? To achieve this will be a big progress in the research of micro robots and smart materials and it will be the next step of our research," said Zeng. The polymer assembly robot

inspired by dandelion seeds is



Zeng.







By Rick Kirkman & Jerry Scott

equipped with a soft actuator made of light-responsive liquid crystalline elastomer. Because of this, the researchers could induce the bristles of the actuator to open or close by exciting it with visible light. According to Zeng, the proof-of-concept built by the team shows that it is an impor tant step towards realistic appli-cation of robots that can act as pollinators

Last year, engineers from the Northwestern University published a research article in the journal Science Robotics about a similar invention. They built various tinv robots that could be con trolled using lasers. At the time, the researchers told that they envisioned controlling a swarm of such robots to carry out various tasks. So the natural question was, can a swarm of FAIRY robots be controlled to pollinate plants in an area? However, researchers at

Tampere University have a radically different approach "Control, coordination, precision in actuation, and manipulation over long distance are words from the field of robotics. In our research, we try to think in a different way. In a biomimicry sense, we try to build the material-based robot smart enough to decide by itself what to do." said

"We can see many examples it nature, when the light illuminat ing condition, temperature and humidity condition meet, the flow ers bloom, and the seeds start to disperse. This is the capability we try to improve in our materials. Zeng explained that the researchers are working on the robot to let it self-adapt to environmental changes and work automatically. Essentially, they could be configured in such a way that their design makes them activate automatically and pollinate plants depending on ideal environmental conditions.



By Jerry Scott & Jim Borgman