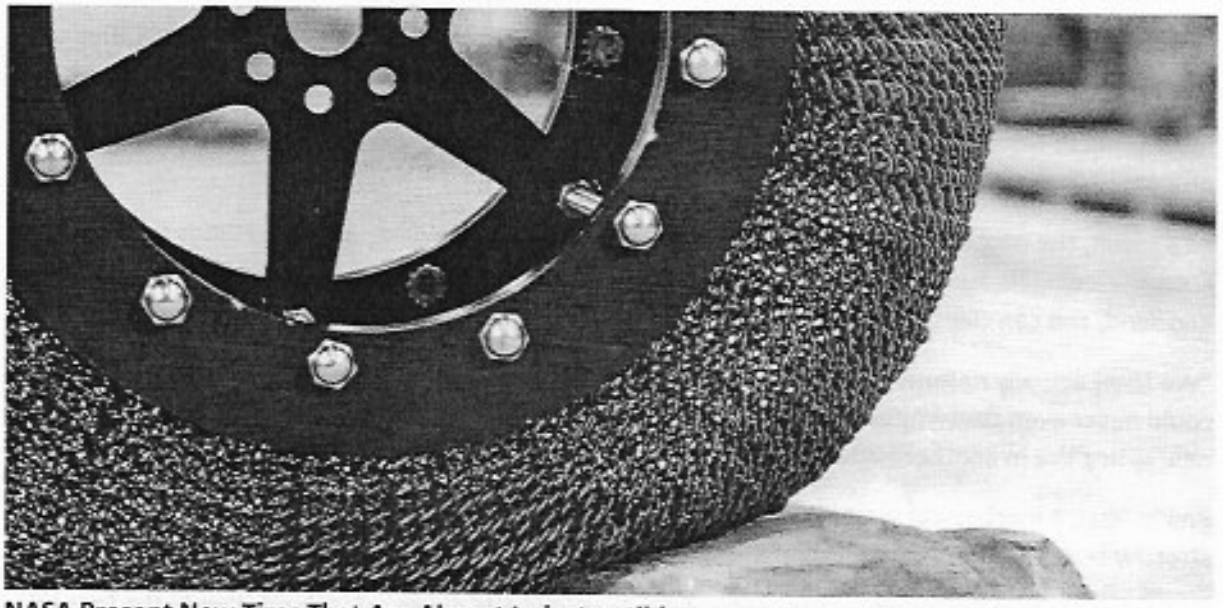


NASA Present New Tires That Are Almost Indestructible

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Ever since man has thought about reaching out to extraterrestrial planets, he has thought of what will he be driving once he gets there. Building vehicles and, more specifically, wheels and tires that will be up for the challenge is no easy task, and so NASA has been experimenting with many different materials over the years.

Take NASA's one-ton, car-size, nuclear-powered Mars Curiosity robot: After just a year of cautious 0.144 kilometers-per-hour roving, small rocks began ripping large holes in its tires.

However, NASA engineers have reinvented the wheel into a form that may one day conquer Mars.

They've created a nearly invincible tire made of woven-mesh metal that "remembers" its ideal shape and immediately springs back into form after taking a beating.

NASA Engineer Colin Creager and his colleagues initially built a woven-mesh wheel made out of spring steel. It gripped soft sand well and supported a lot of weight, yet kept hitting a major snag. "We always came across this one problem of where the tires would get dents in them," Creager said in a NASA video.

Then Creager started using a shape-memory alloy — a super-elastic metal that pops back into place after intense strain.

NASA has been developing space-grade tires since the 1960s, starting with its moon-landing program.

The space agency later set its sights on Mars, spurring development in off-planet wheels. Yet the list of requirements for roving the red planet is daunting. It has to be an All-terrain tire, lightweight, durable, and able to survive wild temperature swings.

To handle scaling a veritable mountain, Curiosity's designers made 20-inch-high aluminum wheels, that were strong and stiff. Yet mission controllers began noticing worrisome dents, holes, and tears in those tires in 2013 — about a year into the mission. Today Curiosity is instructed to avoid small pointy rocks, limiting damage, but the wheels continue to degrade.

"When the current rover wheel damage occurred, we thought it was worth taking a look at that wheel and adapting it for the future," Creager told Businessinsider.com.

After years of research, the team settled on a nickel-titanium (NiTi) alloy and figured out the best process to form and treat it.

As a result, the new wheels boast some impressive stats: They can bear nearly 10 times the weight of Curiosity's wheels, function between -202 and 194 degrees Fahrenheit, have better grip over rocks and sand, and can climb slopes about 23% steeper.

"We [can] actually deform this all the way down to the axle and have it return to shape, which we could never even contemplate in a conventional metal system," another NASA official said of the new spring tire in another NASA video.

Phillip Abel, a mechanical systems expert at NASA, said the key to the tire's performance are the stretchy bonds of the crystal structure in shape-memory alloys.

"With super-elastic materials, what you're doing is storing the energy of deformation in the [crystal structure]. All of the atoms are more or less where they were," but the crystal structure shifts. "The alloy, at the temperatures we're seeing, is always in its 'return to my original shape' mode. So after you deform it, it pops back to its original crystal structure."

In the toughest test to date, the wheels aced 10 kilometers of driving — more than half the total mileage of Curiosity on Mars — on punishing simulated terrain.

"The rim was a little dinged up, but the spring mesh tire was like brand-new," Creager said, adding the caveat that the test did not occur at blistering Martian conditions.

"In theory, they should work, but NASA JPL is building a cryogenic test chamber to verify operation at cold temperatures," he said.

However, those wheels will not be installed on the next Mars rover that will be launched in a few years, the Mars 2020, because it takes a grueling number of tests to prove the viability of a wheel for use on a space mission.

"You can buy nickel-titanium alloy off the shelf, but you can't just use it on Mars. There's a treatment process," Creager said.

On the other hand, they could be ready to roll for the Mars-sample-return mission in 2024.

The wheel's applications aren't limited only to the red planet, though; the researchers are working with Goodyear to put them on Earth-based vehicles. So far, one they attached to a Jeep hugged around rocks without inflicting any damage to the spring tire.

"I could definitely see it being used for any application where you're driving off-road, and the risk of a puncture and a flat is a big deal, like with a military vehicle," Creager said. "But I would love to see this technology branching off to passenger vehicles."