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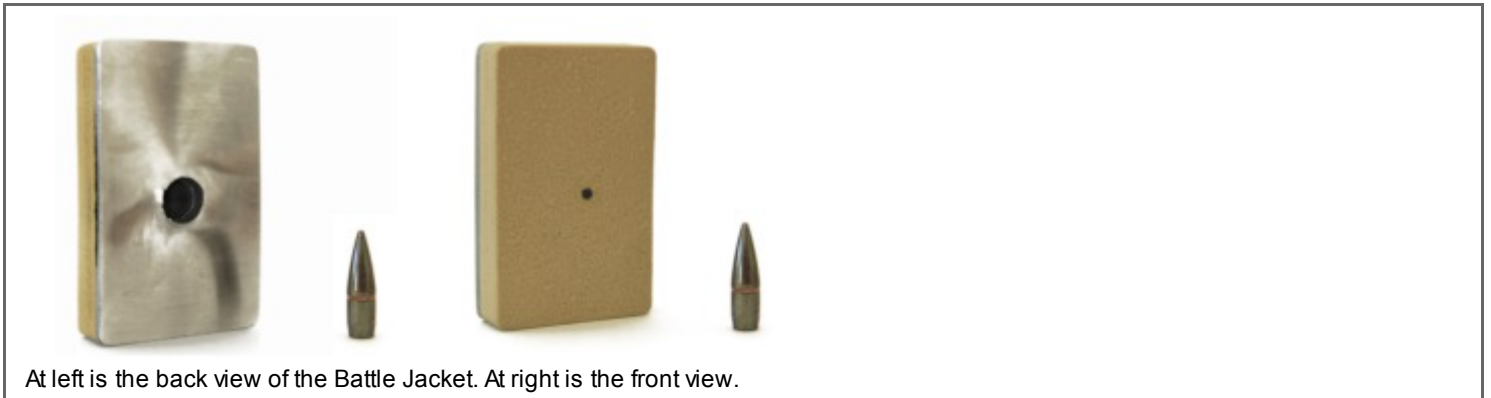
Materials

Products That Heal Themselves

Osman Can Ozcanli , 11.30.09, 6:00 PM ET

Military trucks in battle zones have giant targets on them called fuel tanks. Contrary to popular myth, a fuel tank doesn't explode when pierced by a bullet, but all of its fuel can drain away and catch fire as it does. To counteract this, military trucks are now moving through war zones with tanks that look normal from a distance but can seal themselves after a bullet or shrapnel passes through. It can put an end to fuel loss and accidental combustion.

A company called High Impact Technology is selling this coating under the name Battle Jacket, and it is being used in Iraq on fuel tanks. The puncture-healing coating is extremely inspiring to designers like me because it represents one product in a class of materials that mimics something we only see in living organisms—the property of self-healing. The photos below show how a piece of stainless steel coated on its face with Battle Jacket can seal up after being shot by a bullet, leaving almost no trace of a hole. The photo of the back of the steel plate shows how much damage the bullet actually caused.



At left is the back view of the Battle Jacket. At right is the front view.

The coating is sprayed on fuel tanks in liquid form, and dries hard. When a fast moving bullet hits the coating, its hyper-elastic property lets the bullet through and snaps back to its original shape within in a split-second. Here is a [link to a movie](#) showing the action in slow-motion. The chemistry behind the technology is a trade secret, but High Impact Technology says that it is a polyurethane-based coating with additives that gives it this property.

Wouldn't it be great if a similar technology was used in car tires so a sudden puncture resulting from a large sharp object on the road or a bullet could instantly re-seal?

Over the last five years tire manufacturers such as Goodyear and Michelin have been introducing self-repairing treads using different technologies and have gotten great responses from consumers. Goodyear even has a [calculator](#) on its Web site showing how much you can save when you use its DuraSeal self-Healing tire technology.

Battelle Memorial Institute, one of the largest laboratories in the world, developed a [similar technology](#) a few years ago and it went into use in racetrack barriers for NASCAR. When hit by a fast moving car, the material deforms, absorbs the impact and snaps back to its original shape.

Applications abound for products with self-healing coatings, especially those prone to the annoying, minor scratches that make a product lose its glossy look. Some are already on the market. Two that I have tried use a completely different science than the Battle Jacket. One of them, called Desmodur/Desmophen and developed by Bayer Material Science, a division of Germany's Bayer AG, heals the minor scratches by heat. The healing process happens when left under the sun, or heated

using a simple drier. The Infiniti EX35 from Nissan and the Beetle from Volkswagen have used similar self-healing paints and clear coats. Just a few weeks ago, Nissan agreed to license its self-healing paint technology to Japanese wireless carrier NTT DoCoMo.

The other self-healing coating I have looked at is called HiForm, made by privately held plastics company MacDermid Autotype Ltd. HiForm is a clear plastic with a scratch healing coating that can be molded over plastics as a protective layer. HiForm heals minor scratches by itself, in a few hours. Once scratched, the proprietary material slowly flows back into the scratch. So imagine it as a liquid that flows but is so thick that it is hard to the touch. It is currently being used on cell phone housings and automotive interior bezels. It should find its way into camera lenses and goggles.

Healing larger cracks is a bit harder than filling in shallow scratches. Scott White and his fellow researchers from the University of Illinois at Urbana-Champaign have developed a plastic embedded with tiny capsules containing a polymer healing agent. When the material is damaged, the capsules break, releasing the polymer agent that expands to "heal" the plastic. The same research lab is also working on a vascular system that mimics the blood vessels in our body and when the material breaks, the vessels containing the healing agents heal the material. [Here is a link](#) to that research.

Aerospace, automotive and military applications seem to have a greater need for self-healing materials in the upcoming years. But why not invent shoes, furniture, clothing or even buildings that repair themselves? Products that can repair themselves would mean fewer returns and rejects. You could even imagine products repairing their own defects during the manufacturing process. It would also mean a greener product, because less amount of the product would go to waste. A product that can repair itself would also mean a safer and more reliable product than the competition. Thus, it could be sold for a higher price for a higher profit.

Here are some links from the Inventables database that give more information on some of the materials mentioned above.

[Puncture Healing Coating](#)

[Self-healing Clear Coat](#)

[Self-healing Plastic Sheet](#)

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