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New Polymer Self-Heals Under UV Light (VIDEO)

By Jesse Emspak

Scratches on your car may soon be a thing of the past.

An team of researchers has discovered a way to make a polymer that heals itself, which could revolutionize coatings - and make anyone who has suffered a key dragged on their car much happier.

The research involved Case Western Reserve University, Adolphe Merkle Institute of the University of Fribourg in Switzerland, and the Army Research Laboratory at Aberdeen Proving Ground in Maryland. The group published their results in *Nature*.

The polymer is a type called "metallo-supramolecular," which basically means that it has metal atoms in it. Polymers are usually made with some combination of carbon, hydrogen and oxygen. The distinguishing feature is that they are made of repeating units that build large molecules. Natural rubber is a polymer, as are almost all common plastics.

In the self-healing polymer, the metal ions act as "molecular glue." When irradiated with intense ultraviolet light the assembled structures become temporarily unglued. This transforms the originally solid material into a liquid that flows easily. When the light is switched off, the material re-assembles and solidifies; restoring its original properties.

The team investigated several new polymers to find the combination of mechanical properties and healing ability. They found that metal ions that drive the assembly process via weaker chemical interactions serve best as the light-switchable molecular glue. The result was using zinc and lanthanum, which bond in the right way to the polymer.

This is not at all like most common polymers, which degrade when exposed to ultraviolet light. (This is why some paint coatings turn white or crack in the sun).

To test the material the scientists painted it on a surface with a thickness of about 350 to 400 micrometers, about twice to three times the thickness of a coat of paint on the average car. They scratched it, making marks up to 70 percent of the way through the layer.

Using ultraviolet lamps similar to those that dentists use to cure fillings, the researchers repaired the scratches in less than a minute. The scratches filled up and left no traces. On top of that, the material stood up to repeated scratches.

It's possible to repair many polymers using heat to melt it, but heating isn't as good for targeting specific areas. Light, on the other hand, can be focused more precisely.

Stuart J. Rowan, who led the team at Case Western, said the next step is commercialization. He said the group has spoken to several companies about how to do that.

Case Western's video follows: