This electronic skin can heal itself – and then make more skin

In a quest to make electronic devices more environmentally friendly, researchers have created an electronic skin that can be completely recycled. The e-skin can also heal itself if it's torn apart.

The device, described today in the journal *Science Advances*, is basically a thin film equipped with sensors that can measure pressure, temperature, humidity, and air flow. The film is made of three commercially available compounds mixed together in a matrix and laced with silver nanoparticles: when the e-skin is cut in two, adding the three compounds to the "wound" allows the e-skin to heal itself by recreating chemical bonds between the two sides. That way, the matrix is restored and the e-skin is as good as new. If the e-skin is broken beyond repair, it can just be soaked in a solution that "liquefies" it so that the materials can be reused to make new e-skin. One day, this electronic skin could be used in prosthetics, robots, or smart textiles.

This latest e-skin is special because it's recyclable

Many labs around the world are developing e-skins. One created in Europe allows users to manipulate virtual objects without touching them, by using magnets. Another one developed in Japan can turn a smart shirt into a video game motion controller. This latest e-skin is special because it's recyclable – and that's an important added bonus if you consider that in the US alone, 16 billion pounds of electronic waste was created in 2014. All these circuit boards, transistors, and hard drives can contain toxic chemicals that need to be disposed of properly.

“This particular device … won’t produce any waste,” says study co-author Jianliang Xiao, an assistant professor of mechanical engineering at University of Colorado Boulder. “We want to make electronics to be environmentally friendly.”

So if the e-skin is severely damaged, or you’re just done with it, it can be recycled using a “recycling solution.” This solution dissolves the matrix into small molecules, allowing the silver nanoparticle to sink to the bottom. All materials can then be reused to create another patch of functioning e-skin. The whole recycling takes about 30 minutes at 140 degrees Fahrenheit (60 degrees Celsius) or 10 hours at room temperature. The healing happens even faster: within a half hour at room temperature, or within a few minutes at 140 degrees Fahrenheit (60 degrees Celsius), according to Xiao.

The e-skin isn’t perfect. It’s soft, but not as stretchy as human skin. Xiao says he and his colleagues are also working to make the device more scalable, so that it’ll be easier to manufacture and embed in prosthetics or robots. But it’s the fact that the e-skin can be recycled that gets Xiao excited.

“We are facing pollution issues every day,” he says. “It’s important to preserve our environment and make sure that nature can be very safe for ourselves and for our kids.”

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