

Now a new self-healing, recyclable 'e-skin'

Scientists have developed a new type of malleable, self-healing and fully recyclable "electronic skin" that has applications ranging from robotics and prosthetic development to better biomedical devices.

Electronic skin, known as e-skin, is a thin, translucent material that can mimic the function and mechanical properties of human skin, according to a study published in the journal *Science Advances*. The new e-skin has sensors embedded to measure pressure, temperature, humidity and air flow.

The technology has several distinctive properties, including a novel type of covalently bonded dynamic network polymer, known as polyimine. The polyimine has been laced with silver nanoparticles to provide better mechanical strength, chemical stability and electrical conductivity.

"What is unique here is that the chemical bonding of polyimine we use allows the e-skin to be both self-healing and fully recyclable at room temperature," said Jianliang Xiao, from the University of Colorado Boulder in the US. "Given the millions of tons of electronic waste generated worldwide every year, the recyclability of our e-skin makes good economic and environmental sense."

Another benefit of the new e-skin is that it can be easily conformed to curved surfaces like human arms and robotic hands by applying moderate heat and pressure to it without introducing excessive stresses.

"Let's say you wanted a robot to take care of a baby," said Wei Zhang from the University of Colorado Boulder. "In that case you would integrate e-skin on the robot fingers that can feel the pressure of the baby. The idea is to try and mimic biological skin with e-skin that has desired functions," Zhang said.

To recycle the skin, the device is soaked into recycling solution, making the polymers degrade into smaller molecules like oligomers and monomers. "The recycled solution and nanoparticles can then be used to make new, functional e-skin," said Dr. Xiao.

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