ELECTRONIC MATERIALS

Protective gloves heat up to kill viruses, keep wearer’s skin safe

This reusable glove is made with a material that keeps the wearer’s skin safely under 40 °C while the outer surface heats up to 100 °C for a few seconds when electric current passes through it.

On top of a perforated metal sheet sits a black glove with electrodes on the fingers. There are multiple black wires on the fingers and a red wire with a slightly bulbous end near the wrist of the glove. A person's hand is using a clip to pull on one of the black wires.
Credit: ACS Appl. Mater. Interfaces

Reusable personal protective equipment made with the new material could reduce waste
by Prachi Patel, special to C&EN

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This reusable glove is made with a material that keeps the wearer’s skin safely under 40 °C while the outer surface heats up to 100 °C for a few seconds when electric current passes through it.

A material that reaches 100 °C on one side while staying cool on the other could cut the waste created by the use of disposable personal protective equipment (PPE) such as gloves and masks (ACS Appl. Mater. Interfaces 2023, DOI: 10.1021/acsami.3c09063).

The multilayer decontaminating textile is made of nylon and other commercially available materials. Gloves made with the material keep the wearer's skin at a safe temperature even as their outer surface is heated up for a few seconds to be decontaminated and to kill viruses and other microbes. The gloves can be reused over 900 times—in contrast, using that number of single-use nitrile gloves would create 100 times more material waste.

Even disposable PPE can be reused a few times—as is sometimes needed in under-developed regions or during emergencies and supply crises. But disposable items aren't durable enough for decontamination techniques, such as steam or chemical treatment. Dry heat can disinfect PPE without damaging the fabrics, but it can require minutes to hours to be effective.

As an alternative, researchers have integrated conductive copper wires or graphene layers into PPE materials. Passing electric current through the conductive materials heats them up and kills microbes, but previous attempts were slow to reach sufficient temperatures.

The new material made by Rice University mechanical engineer Daniel J. Preston and colleagues starts with a nylon cloth substrate. On top, they attach a conductive metal-plated polyester fabric cut into a stretchable serpentine pattern, which they coat with a protective nylon film. Under the nylon cloth—the side that will touch the skin—they attach a heat-blocking polyester-spandex layer.

The researchers incorporated their new textile into a glove. They demonstrated two ways to pass current through the gloves' conductive fabric for effective heat decontamination: a portable battery that turns on with a button, and a wall-mounted panel that the user places their gloved hand on to connect to electrical contacts.

Micah Green, a chemical engineer at Texas A&M University, says that while the material is designed to ensure that no one is hurt if they wear the fabric while it is being heated, "users might still be somewhat hesitant to wear a rapidly heated textile." But such rapid, portable decontamination of textiles could be helpful in medical settings and remote locations.

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