Ionically conductive fibers provide a new track for smart and functional textiles

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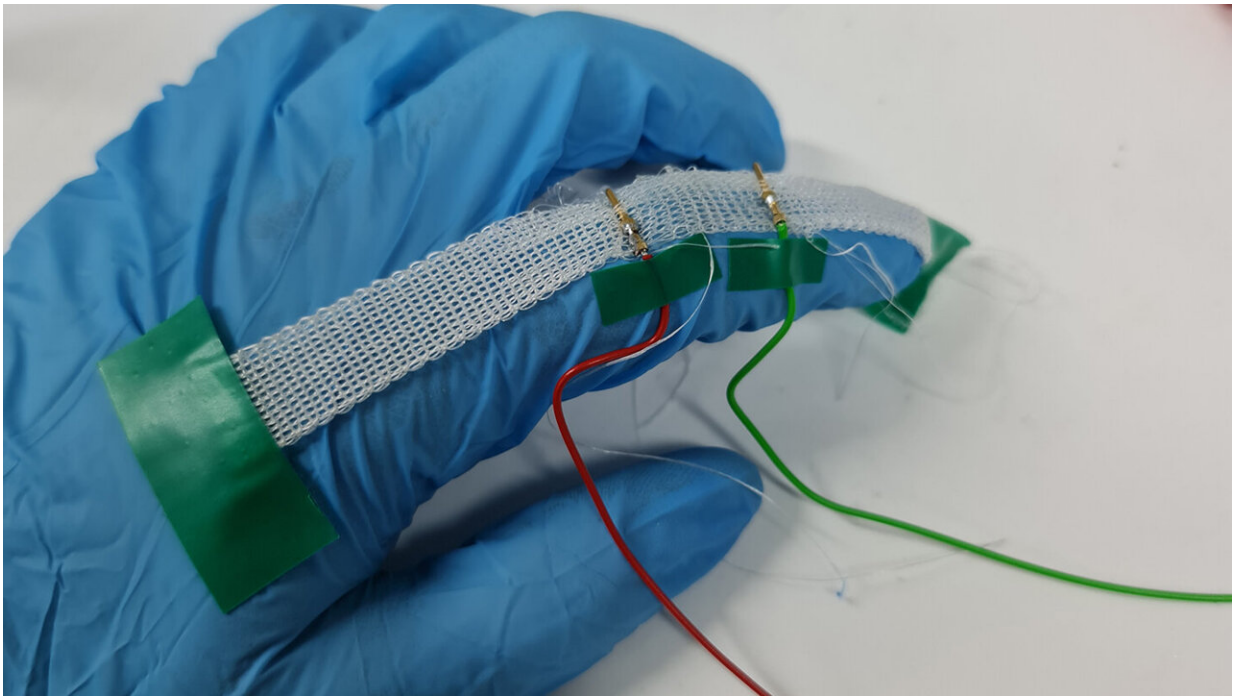

Experiment with ionofibres. Credit: Claude Huniade

Electronically conductive fibers are already in use in smart textiles, but in a recently published research article ionically conductive fibers have proven to be of increasing interest. The so-called ionofibers achieve higher flexibility, durability and match the type of conduction our body uses. In the future they may be used for such items as textile batteries, textile displays and textile muscles.

The research project, which appears in *Advanced Materials Technologies*, is carried out by doctoral student Claude Huniade at the University of Borås, Sweden, and is a track within a larger project, Weafing, the goal of which is to develop novel, unprecedented garments for haptic stimulation comprising flexible and wearable textile actuators and sensors.

In Claude Huniade's project the goal is to produce conductive yarns without conductive metals.

"My research is about producing electrically conductive textile fibers, and ultimately yarns, by coating non-metals sustainably on commercial yarns. The biggest challenge is in the balance between keeping the textile properties and adding the conductive feature," says Claude Huniade.

Currently, the uniqueness of his research is in the strategies employed when coating. These strategies expand to the processes and the materials used.

Ionic liquid

One of the tracks Huniade investigates is a new kind of material used as a textile coating—ionic liquids in combination with commercial textile fibers. Just like salt water, they conduct electricity, but without water. Ionic liquid is a more stable electrolyte than salt water as nothing evaporates.

"The processable aspect is an important requirement since textile manufacturing can be harsh on textile fibers, especially when upscaling their use. The fibers can also be manufactured into woven or knitted without damaging them mechanically while retaining their conductivity. Surprisingly, they were even smoother to process into fabrics than the commercial yarns they are made from," explains Huniade.

Ionofibers could be used as sensors since ionic liquids are sensible to their environment. For example, humidity change can be sensed by the ionofibers, but they can also sense any stretch or pressure they are subjected to.

"Ionofibers could truly shine when they are combined with other materials or devices that require electrolytes. Ionofibers enable certain phenomena currently limited to happen in liquids to be feasible in air in a lightweight fashion. The applications are multiple and unique, for example for textile batteries, textile displays or textile muscles," says Huniade.

More research is needed to combine the ionofibers with other functional fibers to produce the unique textile devices.

And how do ionofibers stand out compared to common electronically conductive fibers? "In comparison to electronically conductive fibers, ionofibers are different in how they conduct electricity. They are less conductive, but they bring other properties that electronically conductive fibers often lack. Ionofibers achieve higher flexibility, durability and match the type of conduction that our body uses. They actually match better than electronically conductive fibers with how electricity is present in nature," Huniade concludes.

More information: Claude Huniade et al, Ionofibers: Ionically Conductive Textile Fibers for Conformal i-Textiles, *Advanced Materials Technologies* (2022). DOI: 10.1002/admt.202101692

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