A ski jacket that actively gets rid of sweat

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Credit: AI-generated image (disclaimer)

To keep the body warm and dry during winter sports, high-performance clothing is a must. The demands on these textiles are high, as a person sweats up to one liter per hour on his upper body alone when skiing. A new technology, co-developed by a team of Empa scientists, helps athletes sweating by actively transporting moisture away from the body and to the outside. This is possible because ultra-thin layers of gold in the fabric are electrified.

Man is warm-blooded. If it gets too hot, humans can tune down their body temperature. This feat is achieved by an evolutionarily refined "AC system" in the skin: the sweat glands. However, evolution did not account for winter sports, so heat balance is thrown into a spin while skiing. A technology developed at Empa in St. Gallen in cooperation with the Thalwil-based company Osmotex and other industrial partners is designed to keep athletes warm and dry – thanks to "electrical" textiles.

An important component of the HYDRO_BOT technology is a principle that enables plants to draw in water from the soil via their roots: osmosis. With the new type of sportswear, this principle is accelerated even further by applying around 1.5 volts. To ensure that liquid is actively transported from the inside to the outside by means of electro-osmosis, a polymer membrane with a thickness of only 20 micrometers is plasma-coated on both sides with a noble metal. This is achieved by using just under 0.2 grams of gold per ski jacket, which has an impact on the price of the membrane. However, gold has proven to be significantly more durable than silver-coated electrodes.

When an electrical voltage is applied to the membrane, salt ions and the surrounding liquid migrate through tiny pores in the membrane to the outside. For this purpose, the membrane is equipped with a conventional battery, which can be switched on depending on weather and body activity. "Even without current, liquid passes through the membrane. However, as soon as an electrical voltage is applied, the pumping effect increases significantly," says Dirk Hegemann from Empa's Advanced Fibers lab. The membrane can pump out about 10 liters of liquid per square meter and hour by electro-osmosis.

For the final product, though, the electro-osmotic membrane will be integrated into a ski jacket within various functional layers. "Thanks to our new physical and numerical models, we were able to optimize the

textile structure of the HYDRO_BOT technology," explains Simon Annaheim from Empa's Biomimetic Membranes and Textiles lab.

Prototype of the electro-osmotic jacket at the international sports fair ISPO in Munich. Credit: Osmotex

Experiments in the climate chambers at Empa showed that the electro-osmotic principle meets the physiological requirements of the human body. Here, the anatomically shaped sweat manikin SAM simulates how the human body behaves during exercise. SAM moves, heats up and ejects precisely defined quantities of liquid through 125 tiny nozzles. "SAM and the data it provided us with enabled us to objectively analyze the wearing comfort and functionality of HYDRO_BOT clothing," says

Annaheim.

Osmotex expects jackets with the HYDRO_BOT technology to be launched on the market for the 2018/19 season.

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