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Technology Frontier

News Bite on PolyU's Innovation

Keeping out the cold with powered wearables

An innovative new textile that turns everyday clothing into mobile heaters

A wearable technology recently developed by researchers at The Hong Kong Polytechnic University is about to change the way we dress in winter. The innovative lightweight textile can be heated up to desired temperatures with external portable renewable or rechargeable power sources, yet without the need to employ conventional thermal insulation materials. In other words, it can keep us warm yet free of bulky winter clothes when the mercury falls. It is a shining example of the integration of textile technologies with garment design by the Institute of Textiles and Clothing, which continuously sets new standards for the textiles and garments industry for the betterment of our lives.

Electronic heat-generating knitwear

Heat-trapping garments usually fly off the shelves when winter is approaching. Materials that capture natural body heat such as wool and cotton are good and comfortable, but body warming technology is moving beyond the method of insulation. An innovative new fabric which is capable to generate heat has been developed by researchers at the Institute of Textiles and Clothing. It is warmer, thin and light, providing an alternative to conventional thermal underwear, woollen sweaters and thick scarves.

The innovation is a warming textile that actively generates heat, leaving the wearer literally bathed in warm currents. "We have successfully created a heat-generating textile based on theoretical resistive network modelling technology by blending conductive materials such as silver in yarns to make them conductive. The silver coated yarns are then woven or knit into fabrics that can produce heat when connected to power," said the principle investigator Dr Li Li. When the textile receives signals from the switch, it will radiate heat according to demand without irritating the skin. For specific purposes such as medical therapies, the temperature of the textile can be adjusted to reach 80 degrees Celsius at maximum.

In addition, the pattern of the warmth can be controlled by adjusting the temperature at different parts of the textile. Through advanced knitting techniques, a textile with separate pieces of fabrics seamlessly combined can be constructed. These separate pieces can be knitted or woven, or it can

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Many colours, patterns and design possibilities can be achieved with the new technology.

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even be lace, providing softness and comfort for the wearer. The pieces of fabrics combined can produce different levels of heat at the same time, as the temperature of each piece can be adjusted individually. Not only can it be used to protect specific body parts from getting cold, it can also be applied in heat therapy. For instance, neck and back pains which are common complaints among office workers can be alleviated by raising the temperatures of the corresponding portions of a therapeutic garment.

To demonstrate a seamless marriage of function and design, it is made aesthetically beautiful. The embedded silver is hidden in pattern design, creating a nice and natural look. Many colours and patterns can be achieved, along with ample design possibilities. The finished garment will keep the wearer warm while looking fashionable at the same time, according to the team. Other good qualities of the textile, such as fineness and smoothness, will also guarantee good comfort.

Surely, demanding customers will be looking for more, such as energy-consciousness. According to Dr Li, a small lithium-ion battery will keep an undergarment running for three hours. The batteries can be removed from the textile easily for washing. Furthermore, they require no special care and are machine washable, as its conductivity and quality will last even after repeated washing.

Powered-garments will make a nice companion to winter activities. A thin layer of the smart textile will keep one noticeably warmer, and that works best for outerwear when the cold is ferocious in the wild. Whether you are snowboarding in the Alps or mountaineering in the Cascade Mountains, the risk of hypothermia will be dramatically lowered. It will also be easy for the wearer to adapt to varying temperatures throughout the day by adjusting the power and temperature settings.

The fabrics with active heat can also give better protection to the elderly and the frail when they fail to generate enough warmth on their own.

Moreover, heating products for the household, such as blankets, bed sheets, mattresses and wallpaper, can also be made with the heat-generating textile to keep our home cozy and warm throughout cold winter nights in the near future.

Quality and safety tests on the textile have already been completed, and the satisfactory test results proved that the fabrics were resistant to moisture, sweat and chemical corrosions. To ensure total peace of mind, there are future plans to perfect the technology, where more safety features will be added, such as power cut-offs and heat-regulating devices against overheating. In the long term, Dr Li's team is looking to work with garment or healthcare supply companies to introduce heating garments to the market.

Representing the clothing of the future, the unique technology has recently won a Silver Medal at the 42nd International Exhibition of Inventions of Geneva in Switzerland.