

應用導電材料設計新型發熱功能性紡織品

A Novel Wearable Thermal Functional Textile with Conductive Materials

研究可自由設定圖案、發熱位置及溫度的新型發熱紡織品

A contemporary wearable electronic collection with thermal regulation where pattern, heating position and temperature can be customised

專利編號及國家: 12/569,893(美國)

特色與優點

- 有可行性理論依據來設計電子織物；
- 同一面料上可按照設定圖案，多目標位置提供熱；
- 導電路徑和熱區域可被製成不需縫紉等外部修改的織物；
- 節省能源

應用

- 戶外服裝產品
- 家居床上用品
- 醫療保健用品
- 需要提供柔性熱源的潛在應用領域

獎項

- 第42屆瑞士日內瓦國際發明展 - 銀獎 (2014年4月)

本項目運用可穿的電子服裝技術開發新型的發熱織物和相關織造技術，以應用於保暖及醫療領域。

通過導電紗線電阻在織物中發熱的方法，使用針織技術，並選用特種導電纖維，如鍍銀單絲和股紗，通過組合工藝，將纖維和導電纖維加工成多能量態纖維束並定型，在不同織物結構和密度及接觸電阻和長度電阻理論基礎上，生產創新的發熱面料。



可穿的電子發熱織物

- 研究對象赤裸背部的紅外線圖像(圖1)
- 研究對象穿上電子發熱織物後3分鐘(圖2)及20分鐘(圖3)的溫度升幅，紅色及綠色分別示意高溫及低溫
- 研究對象脫掉電子發熱織物後(圖4)，高溫區表示較多血液流至皮膚表面，令疼痛症狀得以緩解

Wearable Electric Heating Knitwear

- Infra-red image of the back of a nude human subject (figure 1)
- Temperature rise after the knitwear was applied to the human subject after 3 minutes (figure 2) and 20 minutes (figure 3), where red and green indicate high and low temperatures respectively
- The knitwear was removed (figure 4). The high temperature regions show that more blood flows to the skin surface of the body so as to alleviate the symptoms of the pains.

Patent No: 12/569,893(US)

Special Features and Advantages

This is a pilot study that established a systematic approach to design conductive textile stitches which include:

- A theoretical foundation for the feasibility of designing electronic fabrics with thermal conductivity
- Provision of heat to multiple target regions with individual and independent temperature settings
- Conductive paths and the heating areas which can be made into fabric without external modifications such as sewing
- Power distribution and energy conservation

Applications

- Outdoor apparel products
- Home thermal products
- Healthcare and medical treatments
- Other potential areas where soft thermal comfort is required

Award

- Silver Medal – 42nd International Exhibition of Inventions of Geneva, Switzerland (April 2014)

The aim of this project is to develop a new generation of thermal textiles and specific manufacturing processes, based on wearable electronic technology, which can be incorporated into textile products for the provision of temperature control both in general apparel and in specialist medical applications.

The creation of the conductive fabric can be achieved by using a combination of textile-based technologies, which include a new form of multi-functional fibre and yarn developed by winding, doubling, twisting and weaving/knitting. A novel thermal fabric can be created on the theoretical basis of the resistive network model, i.e., sheet resistance, length resistance and contact resistance with fabric structure and density.

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