

# 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

### 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

- 按可行性物理理論來設計電子織物
- 可於同一面料上，通過設定發熱圖案及設計織物結構，於多個目標位置提供不同溫度的熱力
- 導電路徑和發熱區域可於織造時加到織物上，而不需使用縫紉等外部修改方法
- 適當的熱力分佈，節省能源

#### 應用

- 日常及戶外服裝產品
- 家居用品
- 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。

此項目以接觸電阻和長度電阻理論為基礎，通過導電紗線電阻在織物中發熱的方法、特別的織造技術和組合工藝，將纖維和特選導電纖維加工成多能量態纖維束並定型，經調節不同織物結構和密度後，生產創新的發熱面料。透過面料上的發熱圖案設計，可以控制發熱的位置、模式和溫度，從而有效地使用能源，達致所需的效果。



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.

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 specialized 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. By designing the heating patterns on the fabric, the heating location, pattern and temperatures can be controlled. This enables efficient use of energy and achievement of desired effect.

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在同一面料上設置多個形狀不同、溫度各異的發熱區  
Multiple heating areas in different shapes and with different temperatures on a same piece of fabric

Patent No: 12/569,893(US)

#### Special Features and Advantages

- A theoretical foundation for the feasibility of designing electronic fabrics with thermal conductivity
- Provision of heat to multiple target areas on the same piece of fabric by designing the heating patterns and fabric structure
- Conductive paths and heating areas can be incorporated into fabric during production, but not added to fabric later on by way of external modifications such as sewing
- Appropriate heat distribution for energy conservation

#### Applications

- Daily and outdoor apparel products
- Home 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)



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