

# 由三維間隔織物製成的智能防衝材料

## Smart Impact Protective 3D-spacer Fabrics of Adaptive Stiffness

### 防護性能優越而舒適度高的智能防衝材料

### Intelligent material with high protective performance and comfort

專利申請編號及國家: 201210047717.2(中國)、14239255(美國)、PCT/CN2012/081379、201210072585.9(中國)

智能防衝材料由衝擊變硬聚合物處理過的三維負泊松比間隔織物製成。這種特別研發的聚合物採用了具智能應力反應特性的微凝膠來製作。處理過的織物平時會保持柔軟，但在受到衝擊時會立刻變硬，並迅速地把衝擊力分散到更大的範圍。衝擊結束後，織物即會回復柔軟。這種嶄新的防衝材料在衝擊防護性能和舒適度方面取得理想的平衡，可以取代現有的聚氨酯泡沫和橡膠來製作高性能的衝擊防護服及裝備。

#### 特色與優點

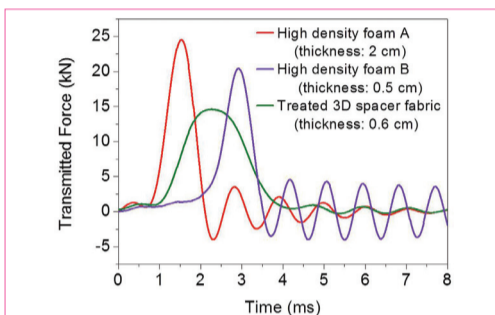
- 防護性能優越，符合歐洲標準EN 1621-1 : 1997
- 透氣度及柔韌度高，因此舒適度良好
- 負泊松比織物的適形性極強，可配合不同的體形
- 可清洗，並可按需要裁剪成不同尺寸和形狀

#### 應用

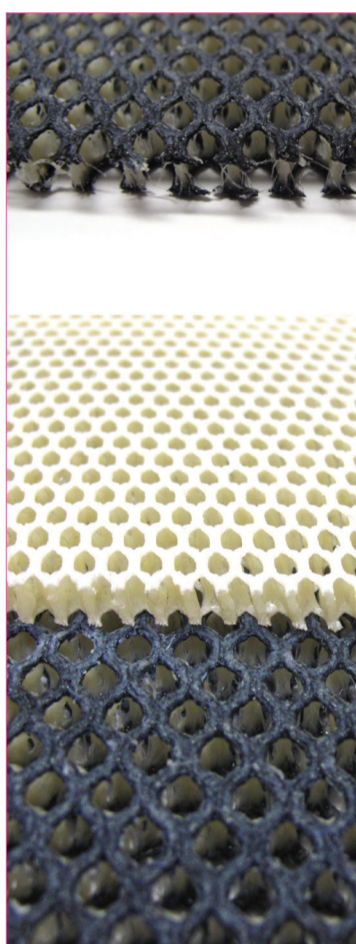
- 運動和軍用衝擊防護服和裝備
- 長者專用的髖關節保護器
- 防護包墊
- 防護襯墊及床墊
- 包裝材料

#### 獎項

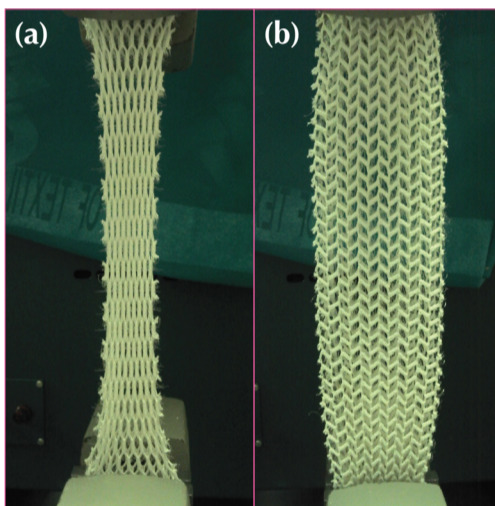
- 第42屆瑞士日內瓦國際發明展 - 金獎 (2014年4月)



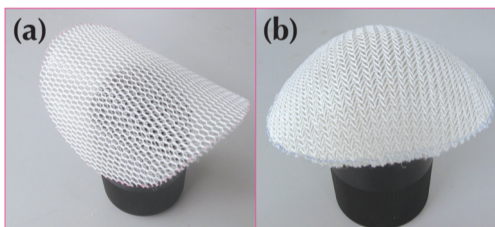
各種材料的衝擊曲線圖 (衝擊能量: 20J)  
Impact curves of various materials (impact energy: 20J)



用衝擊變硬聚合物處理過的三維間隔織物  
3D spacer fabrics treated with impact hardening polymer



間隔織物被用力拉扯時的狀況: (a)普通織物; (b)負泊松比織物  
Spacer fabrics under extension: (a) Non-auxetic fabric; (b) Auxetic fabric



間隔織物的適形性: (a)普通織物; (b)負泊松比織物  
Shape-adaptability of spacer fabrics: (a) Non-auxetic fabric; (b) Auxetic fabric

Smart impact protective material is made of 3D auxetic spacer fabric treated with impact hardening polymer which is specially developed based on smart stress-responsive micro-gels. The treated fabric is flexible during normal use. However, it can instantly get rigid on impact, rapidly transmitting the impact force onto a big area, and become flexible again after the impact. Well balanced between protective performance and comfort, the new fabric is an ideal textile material to substitute polyurethane foams and rubbers which are currently used to produce high-performance protective garment and equipment.

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用智能防衝材料製成的防護運動服裝  
Protective sportswear made of smart impact protective fabric



髖關節保護器  
Hip protector



護肘和護膝  
Elbow and knee protectors

Patent Application No. : 201210047717.2 (PRC), 14239255 (US), PCT/CN2012/081379, 201210072585.9 (PRC)

#### Special Features and Advantages

- High protective performance meeting Standard EN1621-1:1997
- Excellent comfort property due to high air permeability and flexibility
- Very good shape-adaptability of auxetic fabric to body curvatures
- Washable and can be cut to any required size and shape

#### Applications

- Protective garments and equipment for sportive and military uses
- Hip protectors for elderly people
- Protective bags and pads
- Protective mats and mattresses
- Package materials

#### Award

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

A research project of HKRITA



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