

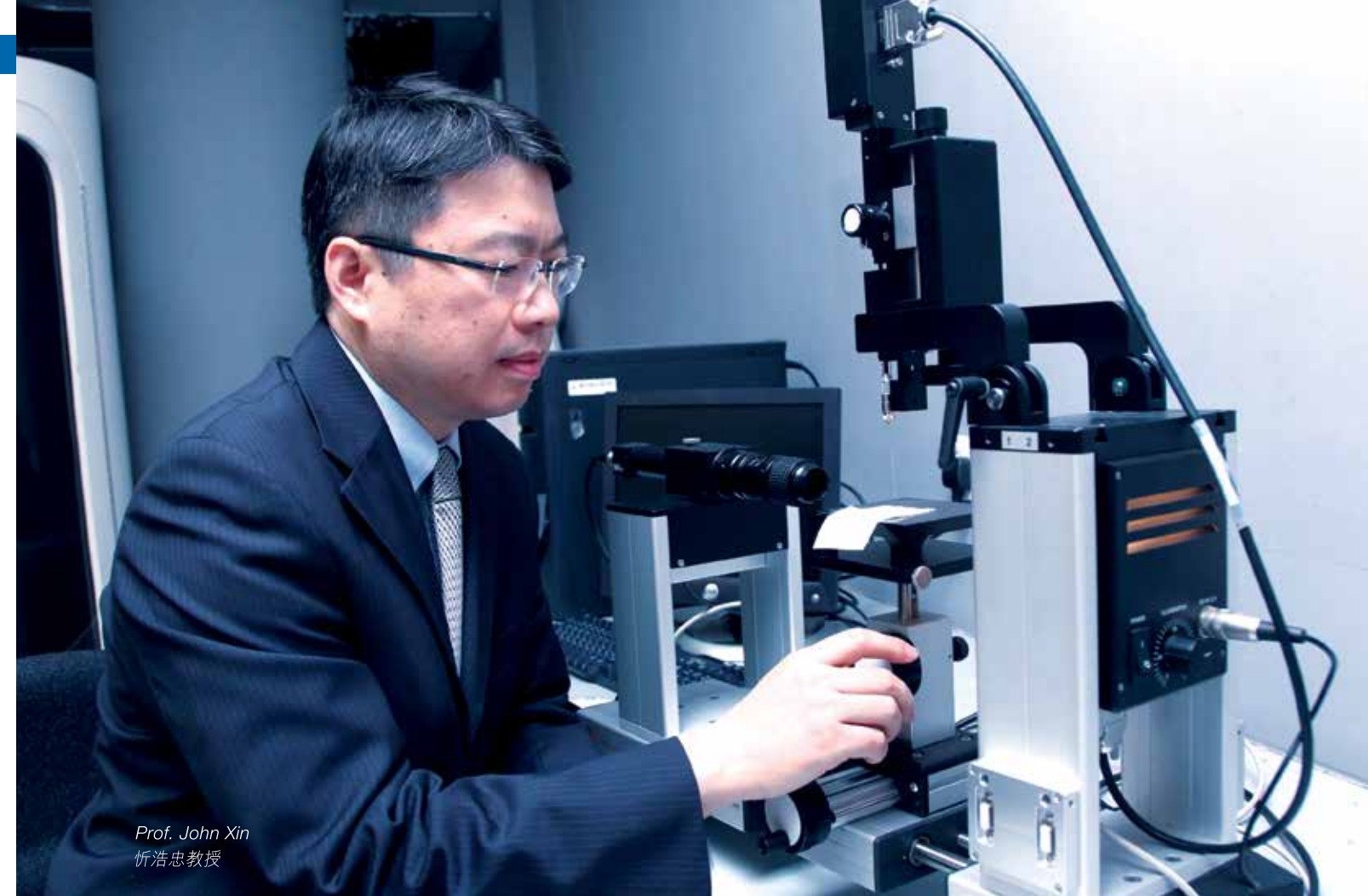
Technology 科技

# Magical cotton collects and releases water as temperature changes

## 神奇棉纖維 隨溫差收集和釋放霧水

Inspired by how beetles and spiders capture water from the environment, researchers have developed a special fog-catching cotton.

甲殼蟲和蜘蛛在空氣中收集霧水的行為，為研究人員提供靈感，從而研發出能蓄集霧水的特種棉布。



Prof. John Xin  
忻浩忠教授

Prof. John Xin, Head and Chair Professor of PolyU's Institute of Textiles and Clothing, his PhD graduate Dr Hengrui Yang and Dr Catarina Esteves from the Eindhoven University of Technology in the Netherlands have developed a special surface-modified fabric by grafting a layer of PNIPAAm polymer onto a standard cotton fabric. Their research findings were published in the scientific journal *Advanced Materials* (Issue 8, February 2013).

When subjected to low temperatures, the modified cotton has a sponge-like structure at the microscopic level. Up to a temperature of 34°C, it is highly hydrophilic and can absorb 340% of its own weight in water from misty air, as compared to only 18% for bare cotton. When the environmental temperature rises to 34°C or above, the material becomes hydrophobic or water-repellant and its structure becomes completely closed. Pure water absorbed at lower temperature is released. This absorption and release cycle as the night-and-day temperature changes can be repeated many times.

The surface modification in the PNIPAAm-enhanced fabric increases the cost slightly by only 12%. The new fabric has the potential to provide water in deserts and mountain regions, and it can be laid directly where water is needed, such as on cultivated soil. The research team is also exploring applications such as camping tents that collect water at night and sportswear that keeps perspiring athletes dry. Researchers are also exploring ways of optimizing the quality of the new fabric, such as through increasing the amount of water it can absorb and lowering the temperature at which it changes from being water-collecting to water-releasing.

大紡織及製衣學系講座教授兼系主任忻浩忠教授、他督導的博士畢業生楊恒銳博士與荷蘭埃因霍芬理工大學(Eindhoven University of Technology) Catarina Esteves 博士研究把一種名為PNIPAAm高分子修飾在普通的棉布表面上，繼而研發出一種特殊改性棉纖維。研究結果於科學雜誌《先進材料》中刊載（第八期，二零一三年二月號）。

溫度低於34°C的時候，在顯微鏡下可觀測到改性後的棉纖維擁有像海綿一樣的微觀結構。它具有超強的吸水能力，能從濕潤的空氣中吸收達自重340%的水分，而未經修飾的普通棉纖維僅能吸濕18%。當溫度上升至高於34°C時，它會自動轉變為疏水狀態，其海綿狀的微觀結構就會收縮和閉合起來，低溫下吸收的水分就被完全釋放出來。這個通過日夜溫差來吸收環境中的水分和釋放水分的過程更可以重覆多次。

以PNIPAAm高分子修飾棉布表面，成本只增加約12%，預期有助解決沙漠或山區等地區之供水問題。它可以被放置在任何需要水的地方，例如耕作的農田上。研究小組正考慮應用此技術來製造晚間收集霧水的露營帳篷及能保持運動員乾爽的運動服。此外，研究人員亦致力優化和完善這材料，增加其吸水的總量，以及調低其由吸水轉變為釋放水分狀態時的溫度等。