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CTCI Science and Technology Research Scholarship

以天然聚合電解質應用在有機場效電晶體與摩擦發電機之特性探討

The Characteristics of Organic Field-Effect Transistors and Triboelectric Nanogenerators with Natural Polyelectrolyte

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研究重點

We demonstrated two kind of green electronic devices, organic thin film transistor (OTFT) and triboelectric nanogenerator (TENG) fabricated with protein-based polyelectrolytes. The side chains of the amino acids in hydrated protein act as good sources of ions and the ions-transfer effect enhances the device performance. In OTFT, spider silk protein was selected as gate dielectric. The effective mobility of the device could be enhanced 30-40 times and the threshold voltage value reduced 10-20 times from vacuum to air ambient. In TENG, gelatin/glycerol film was chosen as triboelectric layer. The device can provide an open-circuit voltage of 82 V and a short-circuit current density of 2.8 mA/m^2 with a peak power density of nearly 150 mW/m^2 in RH60% ,which is able to drive 100 LEDs simultaneously.

研究成果

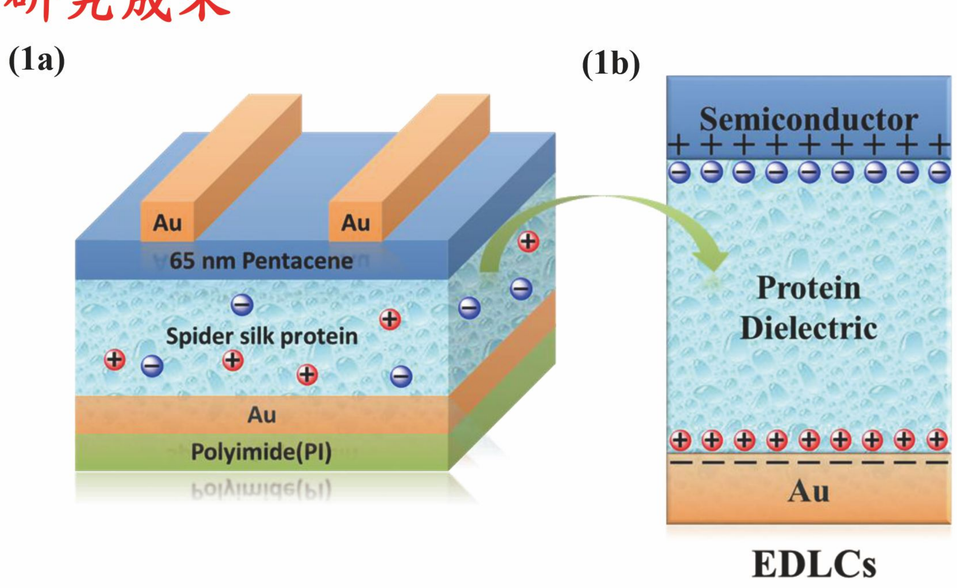

Figure 1. (a) Schematic picture of the pentacene OFET with spider silk as the gate dielectric. (b) Formation of electric double layers capacitors (EDLCs) when the SIM structure with hydrated protein is biased at a voltage.

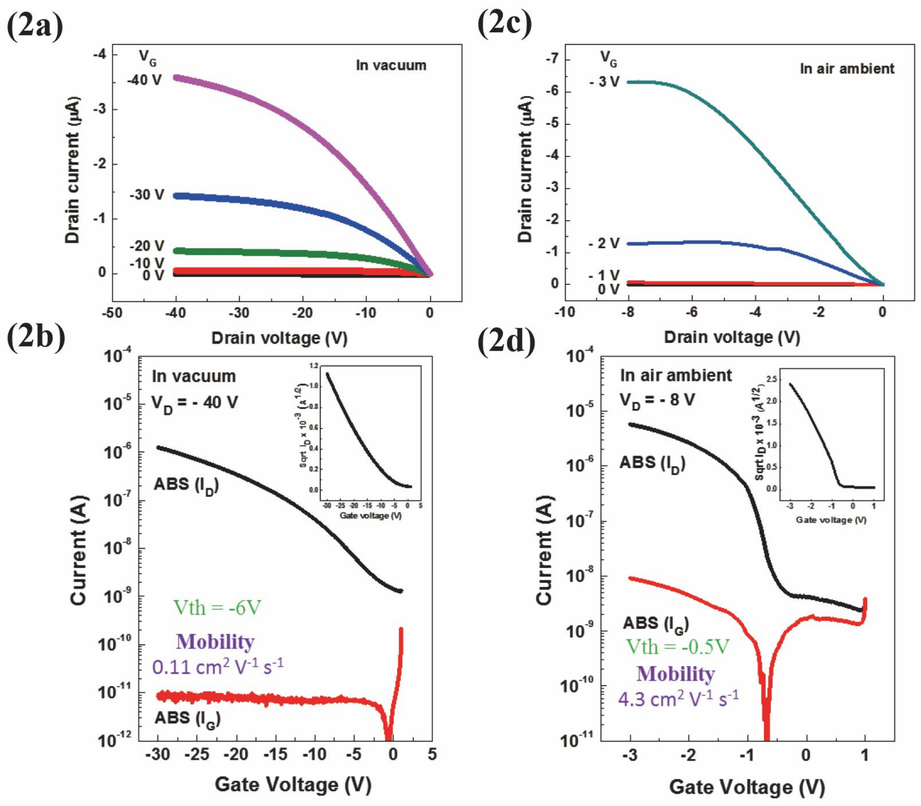

Figure 2. Device characteristics of the pentacene OFET with spider silk Dielectric. (a) Output characteristics in vacuum. (b) Transfer characteristics and gate leakage current in vacuum. (c) Output characteristics in air ambient. (b) Transfer characteristics and gate leakage current in air ambient.

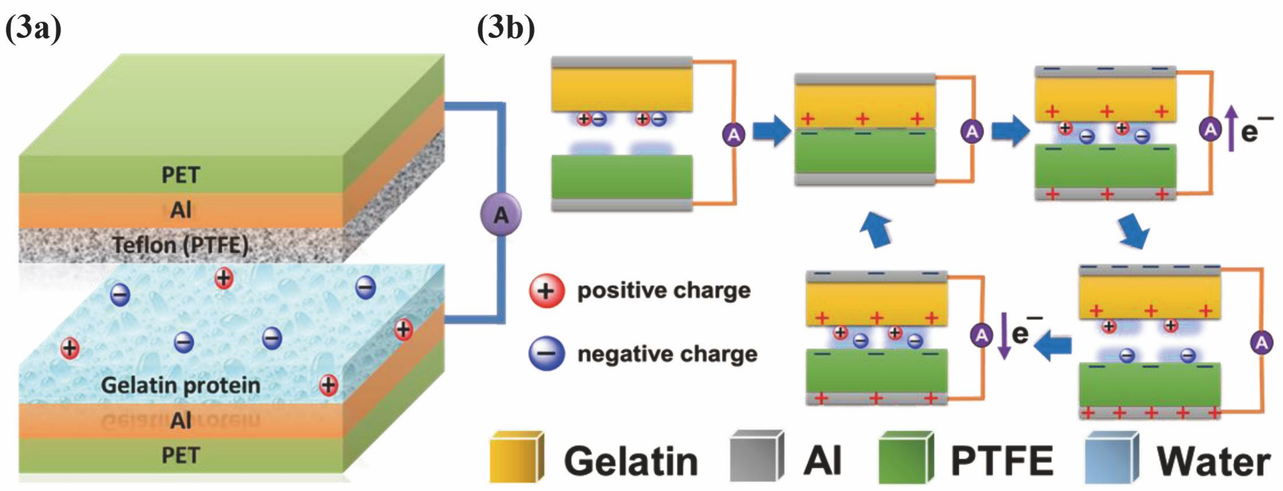

Figure 3. (a) Schematic picture of the gelatin-based TENG. (b) Working mechanism of the gelatin-based TENG at high humidity.

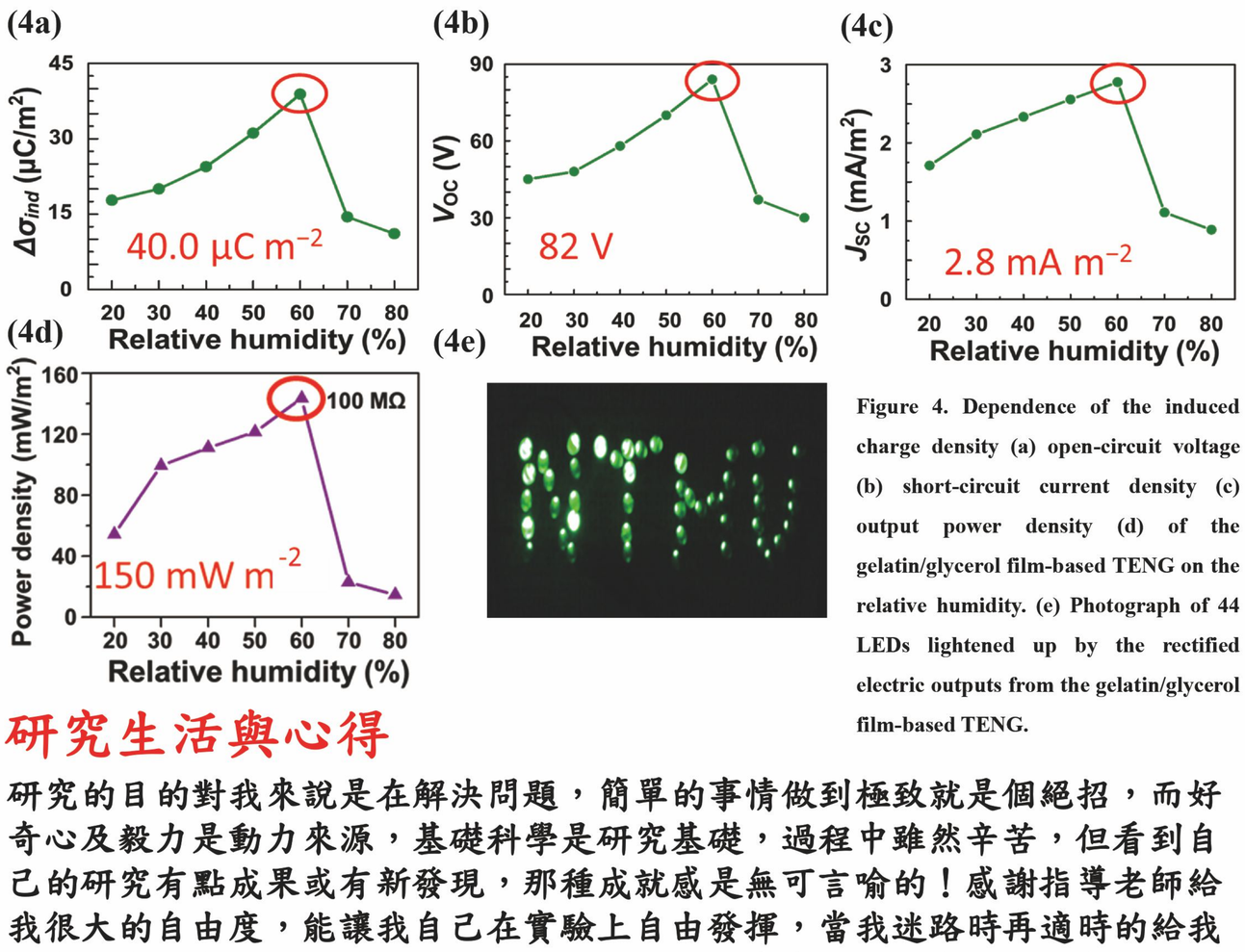

Figure 4. Dependence of the induced charge density (a) open-circuit voltage (b) short-circuit current density (c) output power density (d) of the gelatin/glycerol film-based TENG on the relative humidity. (e) Photograph of 44 LEDs lightened up by the rectified electric outputs from the gelatin/glycerol film-based TENG.

研究生活與心得

研究的目的對我來說是在解決問題，簡單的事情做到極致就是個絕招，而好奇心及毅力是動力來源，基礎科學是研究基礎，過程中雖然辛苦，但看到自己的研究有點成果或有新發現，那種成就感是無可言喻的！感謝指導老師給我很大的自由度，能讓我自己在實驗上自由發揮，當我迷路時再適時的給我方向，感謝家人給予的支持，教會我怎麼做人處事，感謝中技社給我這個機會證明自己，在未來除了認真生活外，也期許自己也能成為回饋社會的一份子，成為一個有溫度的人。

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