An all-printable CNT film-type photo-thermoelectric imager

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1. Introduction

CNTs-related materials have excellent physical and chemical properties and, can be adaptable for various applications including solar cells and capacitors. Furthermore, CNT films are flexible and exhibit broadband photo-absorption properties, making them suitable for stereoscopic imaging by employing CNT films as photo-thermoelectric imagers[1]. On the other hand, from the viewpoint of imaging usage, fine-integration is essential to facilitate high-resolution visualization or video capturing applications.

The conventional method employs the suction filtration process for fabricating the CNT film-type broadband flexible imagers[2]. The device consists of CNT film channels and electrodes, and also requires the chemical carrier doping on the channel. However, manual alignment of each device material component, which is associated with the suction filtration, has been a bottleneck for realizing the fine-integration of the CNT film imager. To this end, this work reports on the all-printable device fabrication by inkjet dispensers, enabling mechanical alignment of each device material component.

2. Results and discussion

Fig. 1a shows the materials used in printing the CNT film-type photo-thermoelectric imager. The channel printing process employs an aqueous solution at 0.5 wt% concentration of the semiconducting-metallic-mixed SWCNTs. In addition, the dispenser performs the chemical carrier doping with an aqueous solution at 0.7 mol/L concentration of 15 Crown 5 Ether and KOH, and the electrode formation with a conductive mixture paste of silver nanoparticles and acrylic resin. As shown in Fig. 1b, the device consists of the printed channel and electrodes on a polyimide substrate. The channel width, length, and pitch are 300 µm, 10 mm, and 2 mm, respectively. Each half region of the originally P-type CNT film channel at the GND side is chemically doped into N-type, and the PN junction corresponds to the photodetection interface.

The presented approach advantageously enables mechanical alignment of respective device materials, and potentially facilitates fine integration of the CNT film-based flexible broadband imagers.

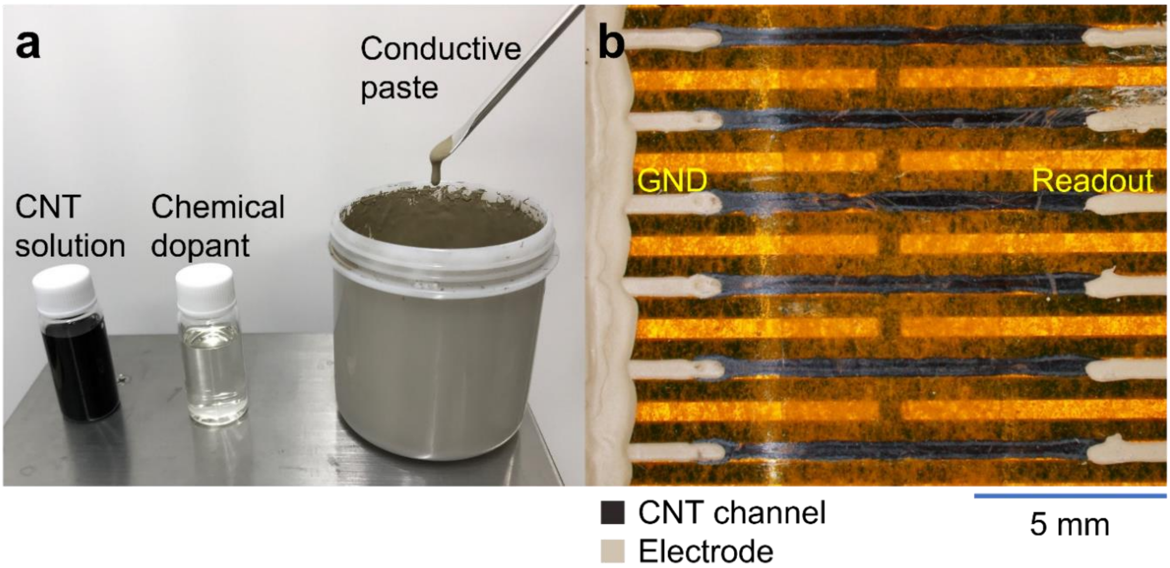

Fig. 1. a, Photograph of device component materials for CNT film-type photo-thermoelectric imager. **b**, Photograph of the printed CNT film photodetector.

3. References

[1] K. Li, et al., Nat. Commun., **12**, 3009 (2021).
[2] D. Suzuki, K. Li, K. Ishibashi, Y. Kawano, Adv. Funct. Mater., **31**,14, 2008931 (2021).