A mechanically stretchable and optically broadband imager sheet

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1. Introduction

This work presents the fabrication of a mechanically stretchable and optically broadband imager sheet. As photo-visualization techniques non-destructively capture physical information in large areas, the use of imager devices facilitate variety of applications including industrial testing, agricultural monitoring, and security screening. For the sensing of transformable objects such as soft liquid tubes, plants, and so on, mechanical stretchability is essential for the imager to stably attach to the outer surface of targets. However, studies on developing stretchable imagers are yet to be fully performed, and some existing stretchable photodetectors only function in narrow ultraviolet or visible light bands. To this end, this work integrates carbon nanotube (CNT) films-based flexible and high efficient broad infrared (IR)–terahertz (THz) absorbers and soft device frameworks. The device collectively satisfies transmissive inner imaging of opaque objects and repetitive mechanical deformation, demonstrating non-destructive inspections of arbitral-structure targets[1].

2. Results

Fig. 1a shows the proposed device. The device consists of flexible CNT film channels and stretchable silver nanoparticles-based stretchable electrodes, and a polyurethane film stretchable substrate. The device functions under photo-thermoelectric (PTE) effect in broadband frequency regions ranging from near-IR to sub-THz, and the PN junction at the center of the channel serves as the photodetection interface[2]. As shown in Fig. 1b, the use of the device enables photodetection even during the whole device stretching, and the device stretchability in universal directions ranges 70–280 %. The obtained device stretchability is well comparable with that of the existing stretchable narrowband photodetector[3].

In conclusion, this work presents the device design of the stretchable broadband photodetector, and its multi-functional sensing and imaging applications will be reported at the workshop.

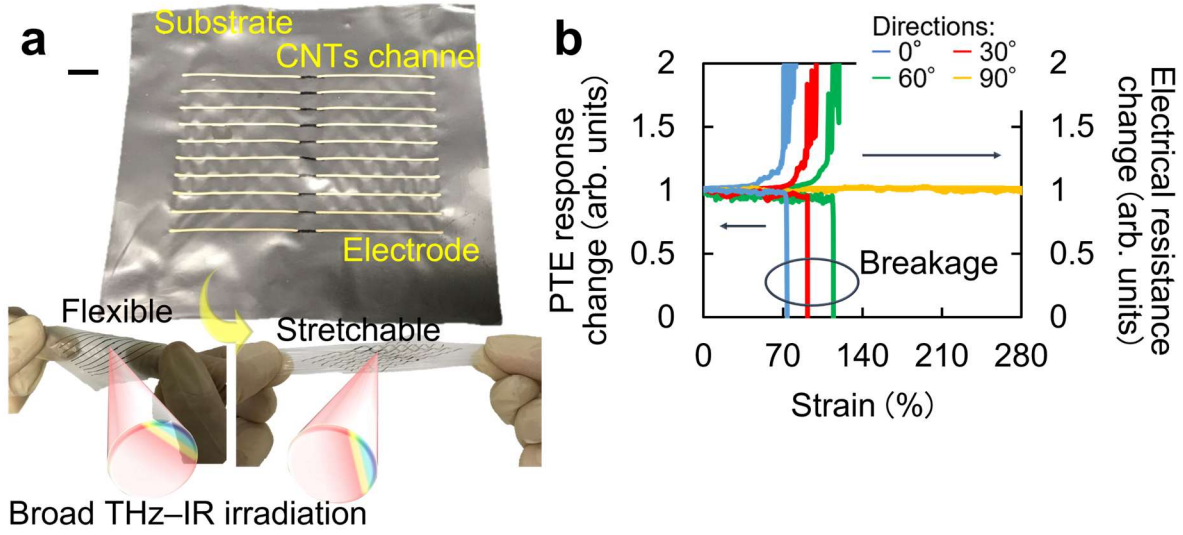

Fig. 1. a, Photograph of the proposed PTE imager sheet, being bent and stretched. Scar bar 3 mm. **b,** Mapping of the PTE responses and electrical resistances of the imager sheet against changes in strain of the device. An IR laser was used as a photo source.

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4. References

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