Journal of Zhejiang University-SCIENCE A

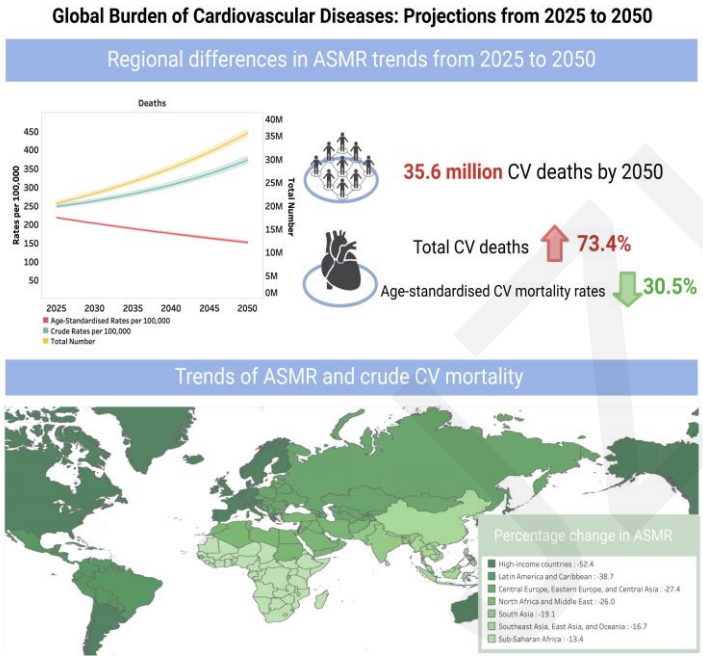
High-sensitivity and robust laser-induced graphene sensing arrays for spatiotemporal pulse mapping

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Cite this as: Guoxi LUO, Diying PI, Wenyan LI, Min LI, Ping YANG, Ryutaro MAEDA, Libo ZHAO, Zhuangde JIANG, 2026. High-sensitivity and robust laser-induced graphene sensing arrays for spatiotemporal pulse mapping. *Journal of Zhejiang University-SCIENCE A*, 27(10):1123-1137.
https://doi.org/10.1631/jzus.A2600182

Background

Over the past two decades, cardiovascular disease (CVD) has remained the leading cause of death globally.

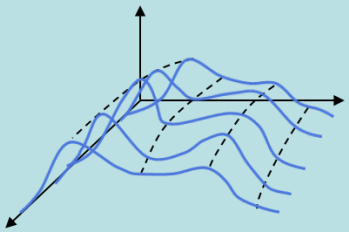


Chong B et al., 2025. *European journal of preventive cardiology*, 32(11): 1001-1015.

Single-point pulse wave sensors are limited to capturing one dimensional intensity signals from a localized wrist position.

VS

Reconstructing the Spatial Distribution Characteristics of the Three Acupoints “Cun, Guan, and Chi”



Design

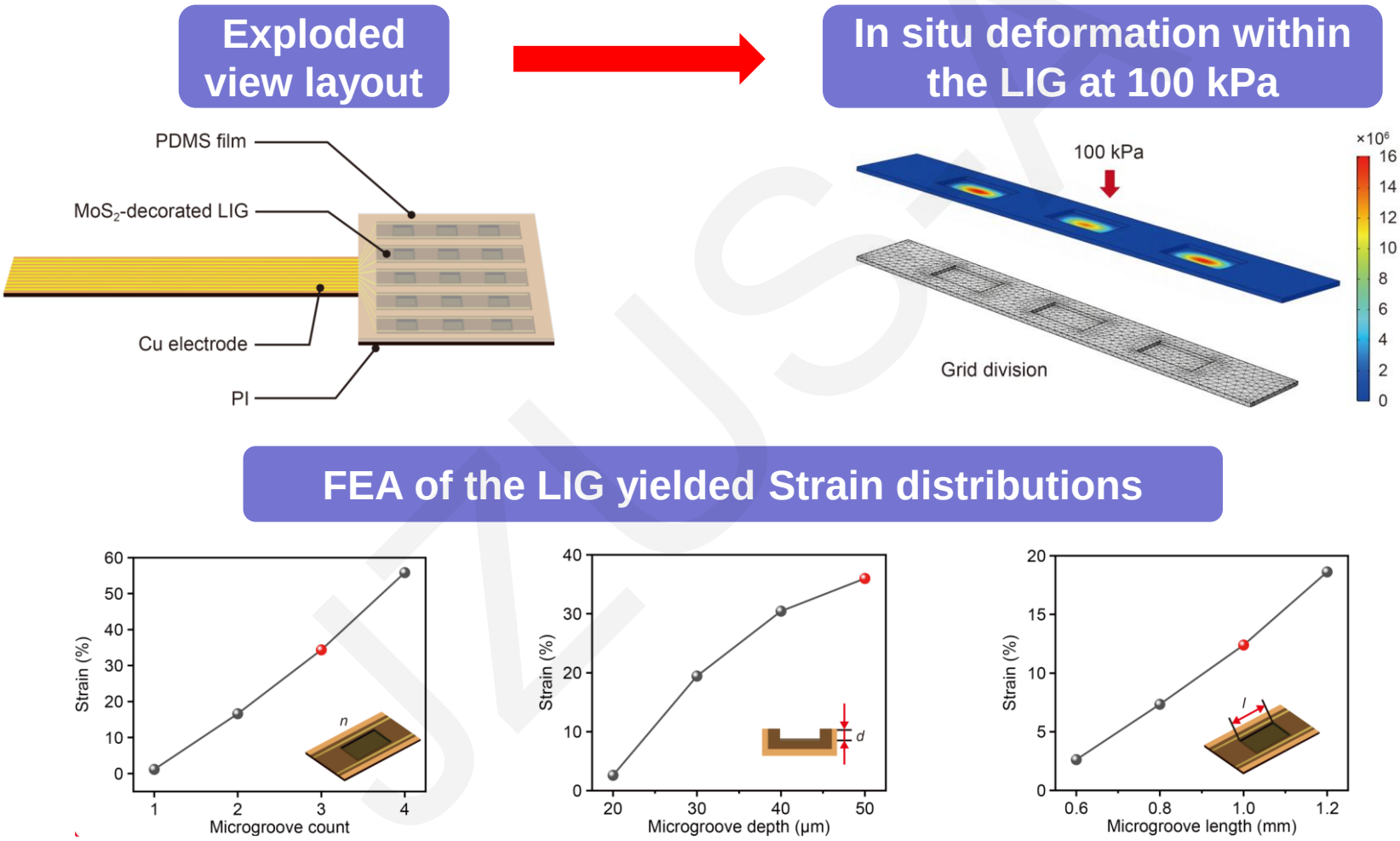
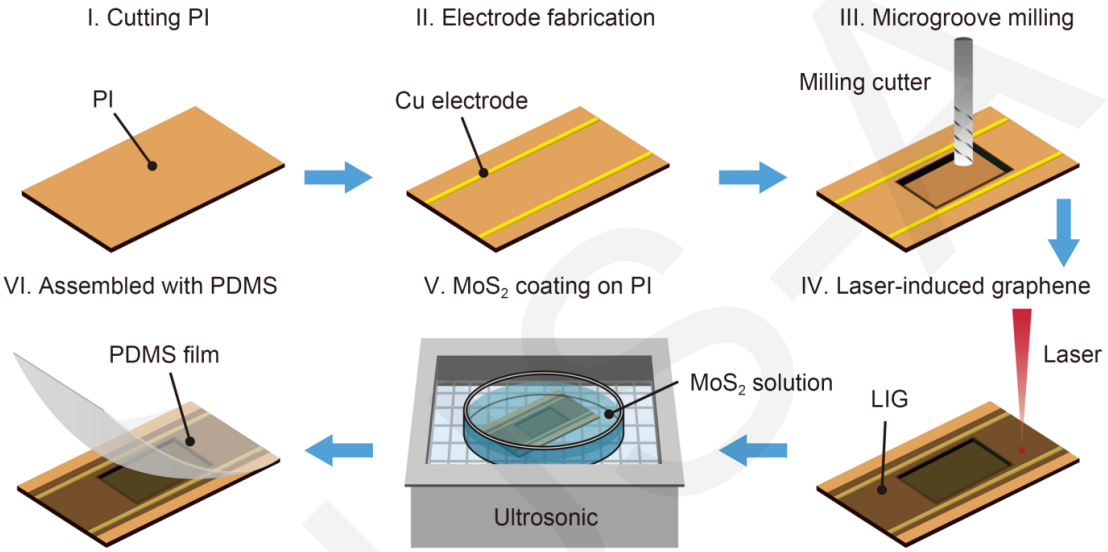


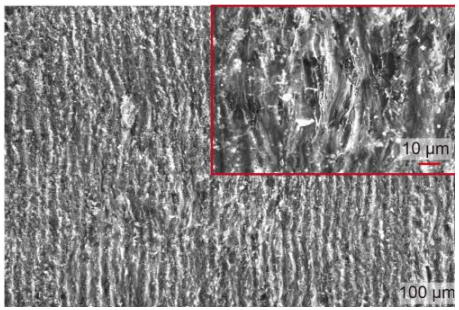
Fig. 1. Design of a 3D laser-induced graphene sensor.

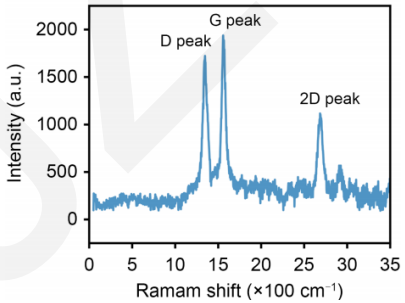
Fabrication

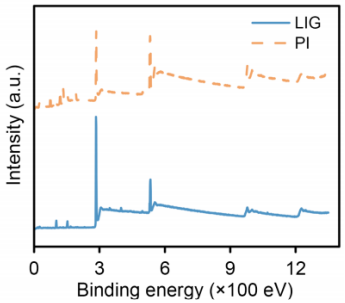
Fabrication process flow for the pulse sensor



Characterization of LIG pulse sensors







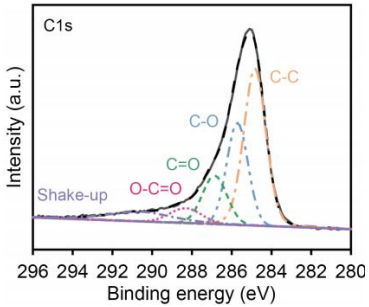
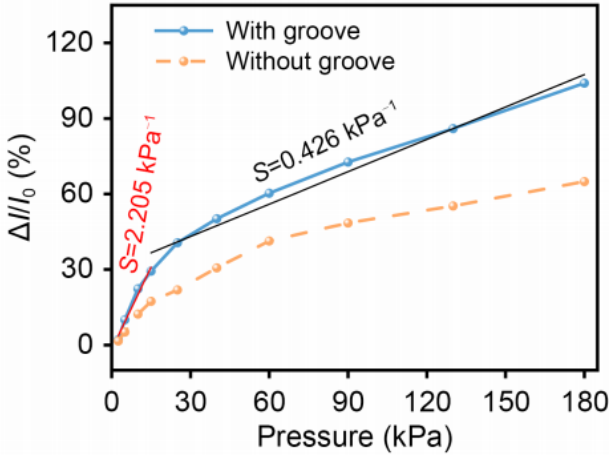


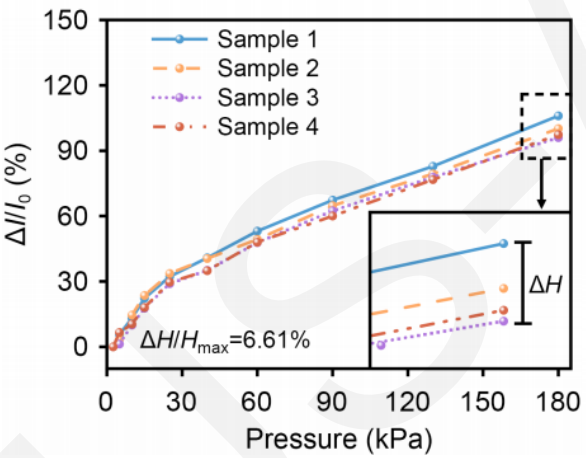
Fig. 2. Fabrication process and characterization of LIG pulse sensors.

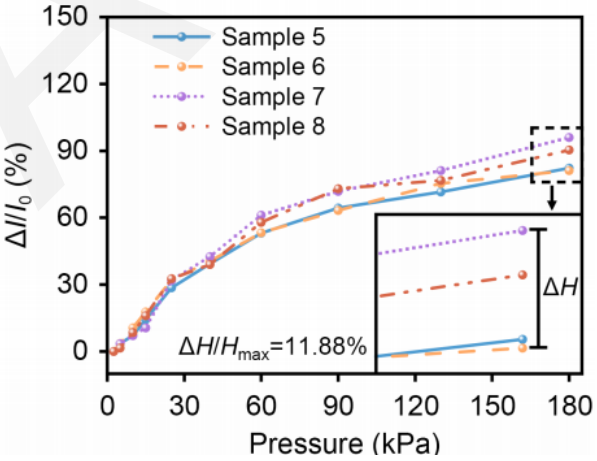
Performance Comparis\on

Sensitivity

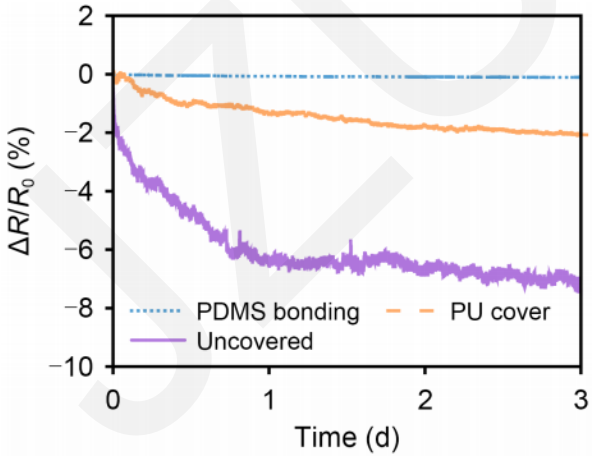


Consistency





Stability



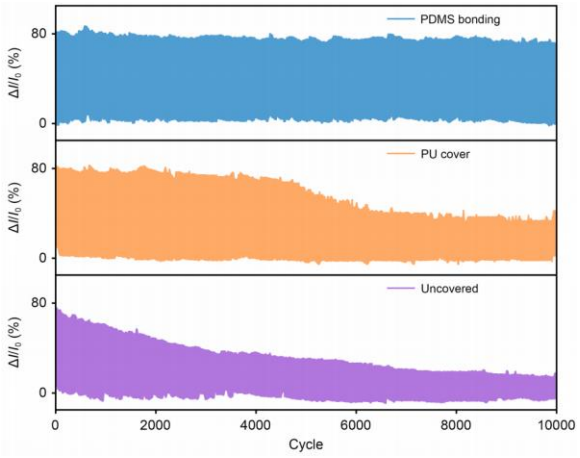


Fig. 3. Performance testing of the LIG pulse sensor.

Applications

■3D pulse signal

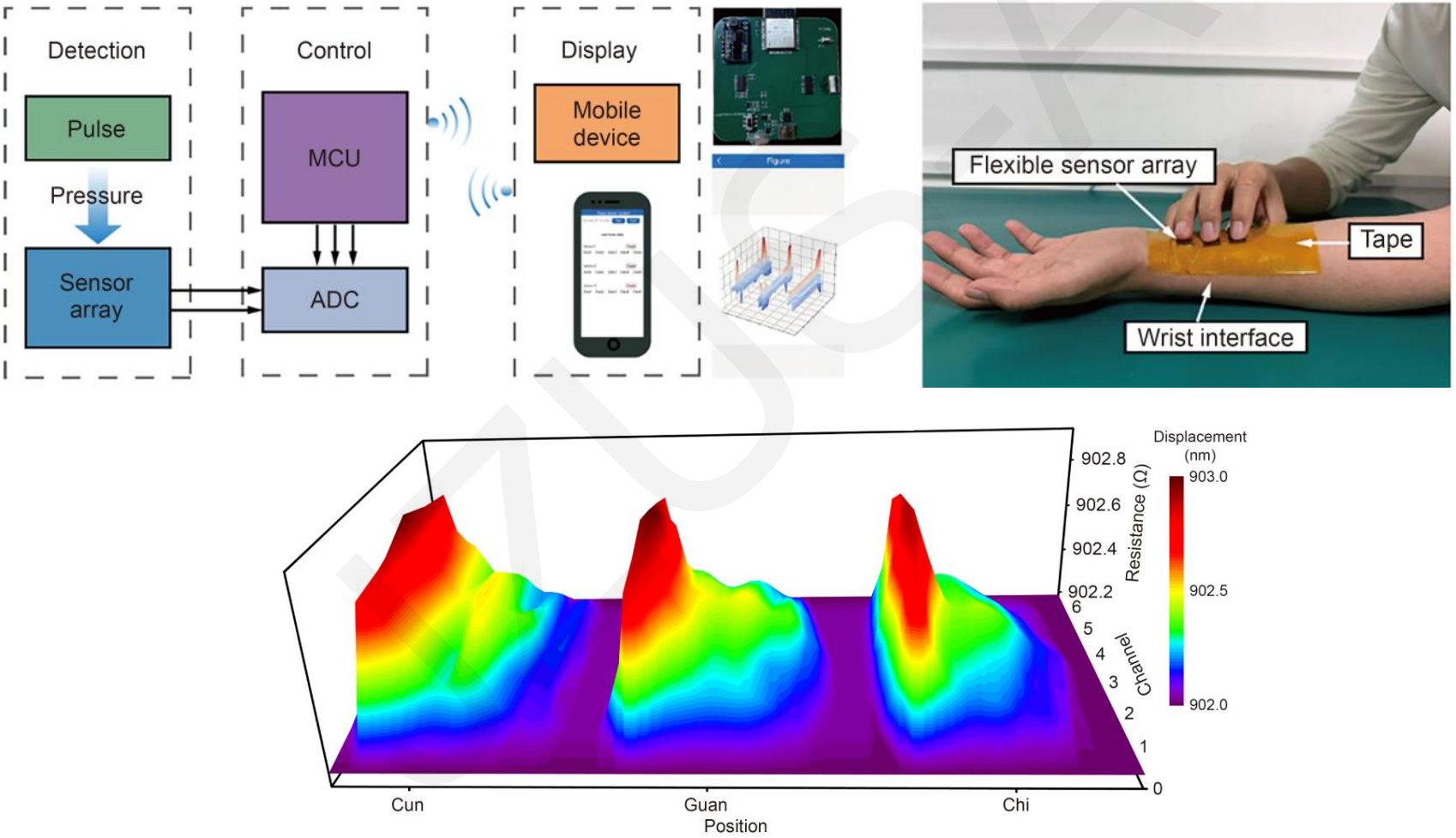


Fig. 4. Applications of the LIG pulse sensor.

Conclusions

- In summary, a design and fabrication method for highly sensitive and robust LIG flexible pulse sensor arrays has been developed. First, a precision machining process was employed to mill microgroove structures on the PI substrate before fabrication of LIG, achieving sensitivity enhancement through the stress concentration effect. Then, the microstructural consistency of the LIG was improved via MoS2 solution modifica-tion, thereby enhancing the uniformity of the electro-mechanical response. Finally, a facile and reliable chemical bonding technique was developed to isolate the LIG from atmospheric moisture, simultaneously enhancing the stability of the sensor's electromechanical response. Consequently, the as-prepared sensor exhibited outstanding performance, such as high sensitivity, good consistency, fast response capability, and excellent stability.