



## PVA/SA Hydrogel Photonic Crystals as Visual Sensors

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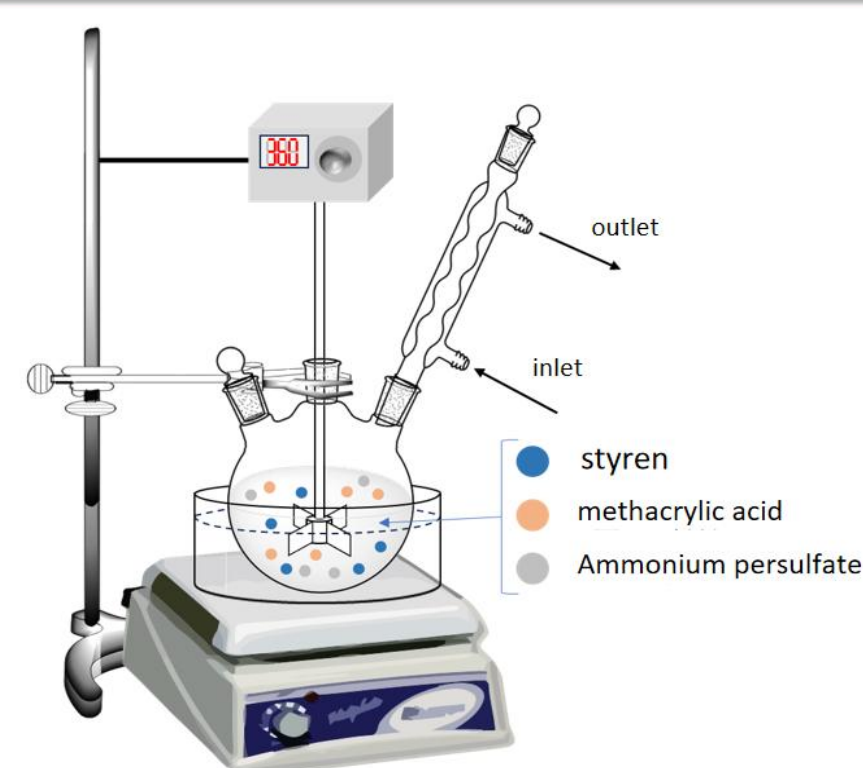
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### INTRODUCTION & AIM

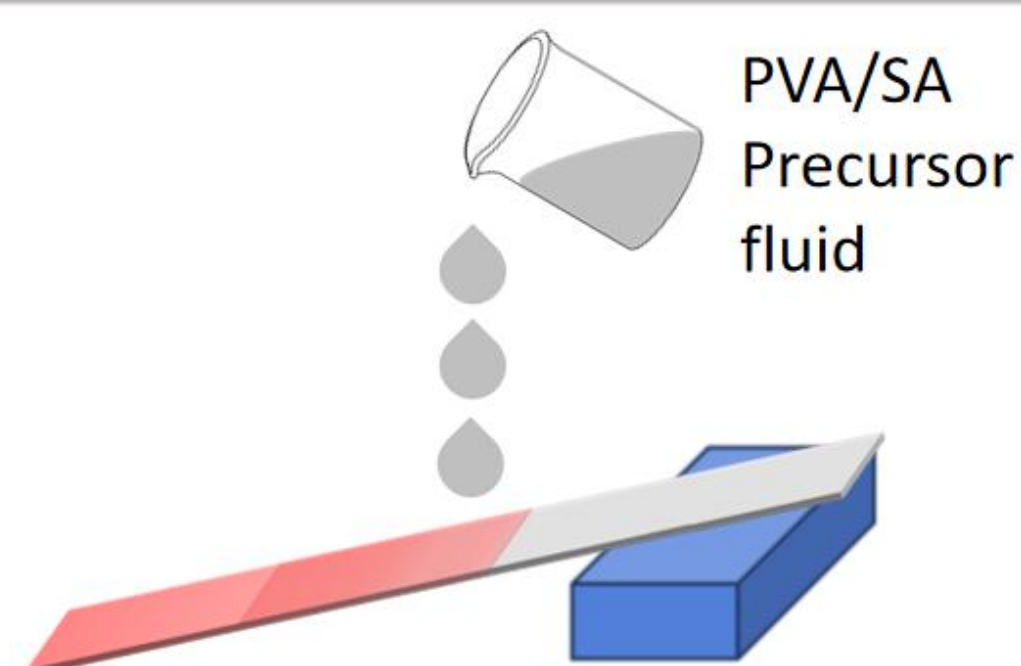
Hydrogel is the most commonly used substrate in the field of flexible sensors. Its special three-dimensional network structure enables it to carry many functional materials, such as high conductivity polymer materials, high mechanical strength materials and high viscosity natural materials.

Flexible sensors developed by using hydrogels can directly show changes. These changes often need to be detected by additional instruments, which greatly increases the cost of sensor use, and also adds trouble to users. Therefore, it is urgent to develop a portable and flexible sensor that can provide timely feedback.

### METHOD



**Fig. 1.** Schematic diagram of polystyrene (PS) synthesis process



**Fig. 2.** Preparation diagram of PVA/SA-PC thin film

#### ➤ Preparation of hydrogel

Prepare a certain mass fraction of PVA solution and SA solution to prepare PVA/SA precursor, then freeze it at  $-20\text{ }^{\circ}\text{C}$  for 24 hours, and thaw it at room temperature for 6 hours to obtain PVA/SA hydrogel.

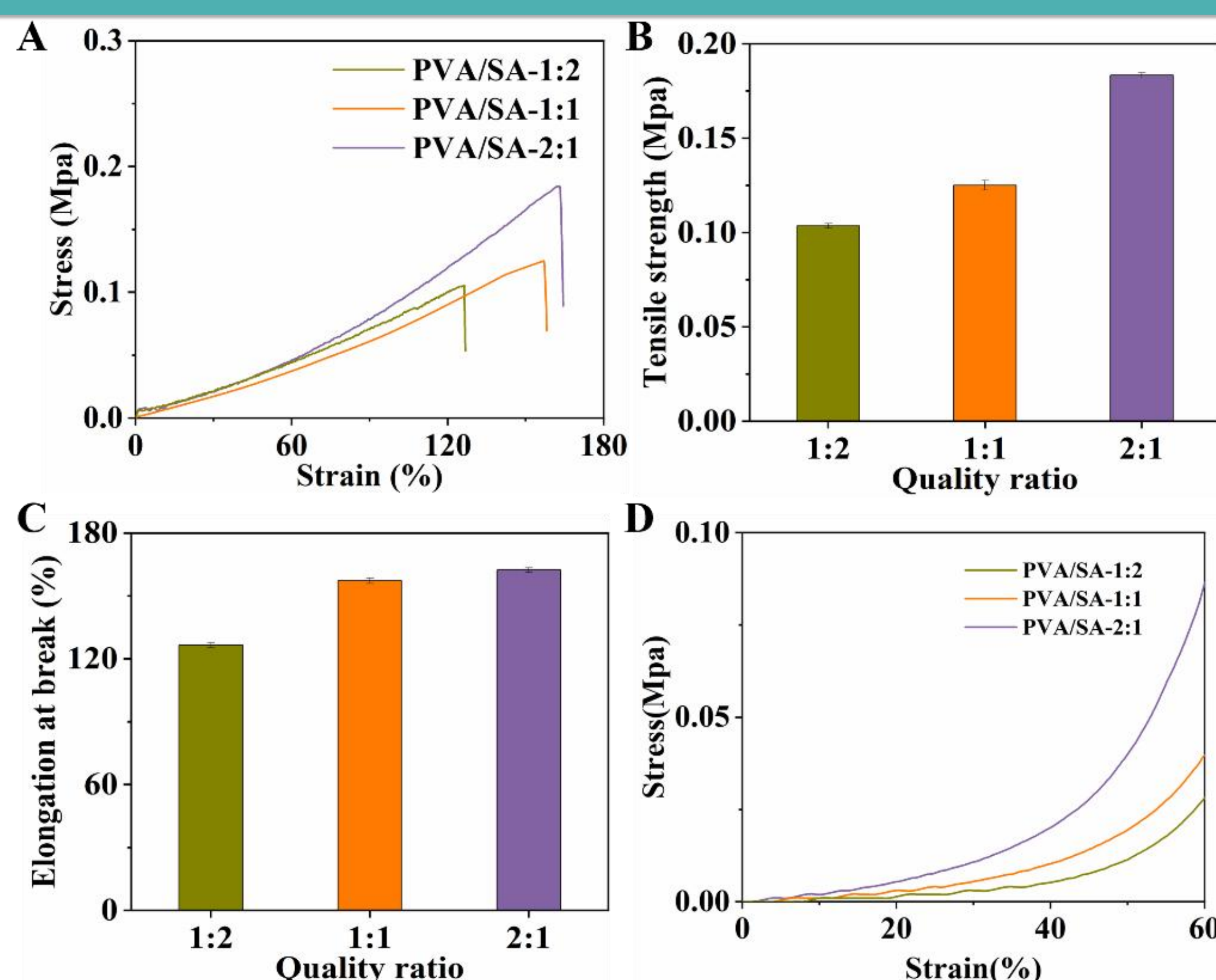
#### ➤ Preparation of photonic crystals (PC)

5mL of methacrylic acid and 200 mL of deionized water was heated to  $98\text{ }^{\circ}\text{C}$  and 80 mL of styrene was added. Then, add 5mL of sodium persulfate solution with a mass fraction of 9.7%. After 20 minutes of reaction, the reaction was finished. The PC was prepared by self-assembly of the resulting latex.

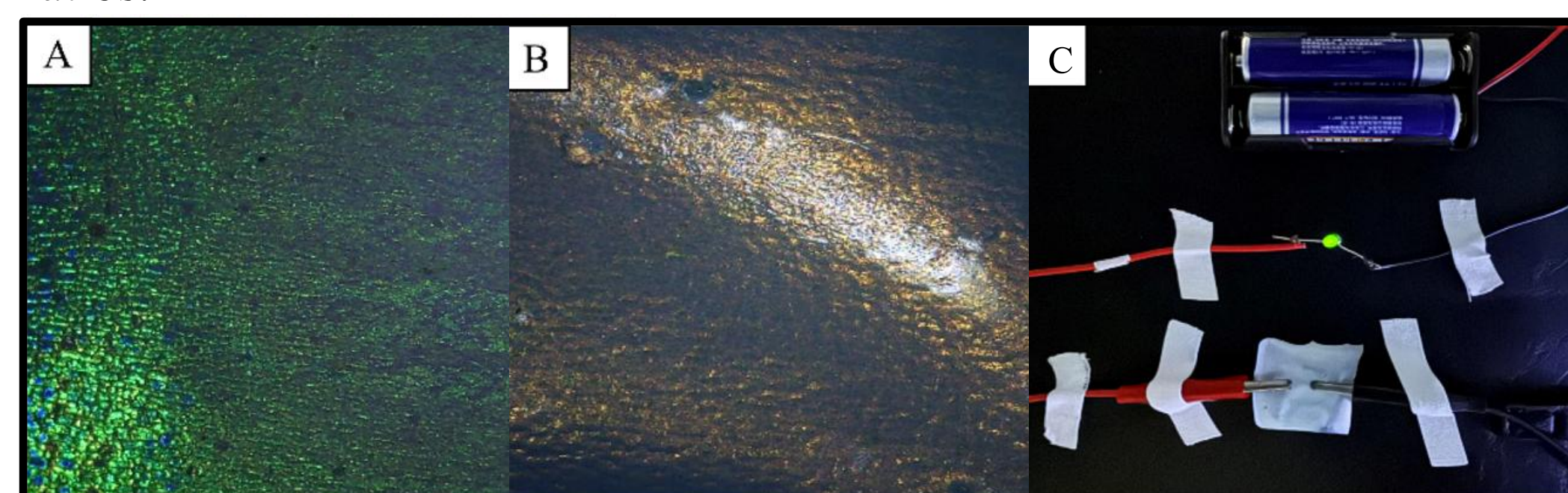
#### ➤ Preparation of PVA/SA-PC thin film section

Place the glass sheet containing the PC template at an angle of  $30\text{ }^{\circ}\text{C}$ , PVA/SA precursor solution was slowly added onto the glass sheet, and then place the glass sheet steadily in a  $70\text{ }^{\circ}\text{C}$  oven to cure the film.

### RESULTS & DISCUSSION



**Fig. 3.** Compression test of hydrogels with different mass ratios. (A) Tensile stress-strain diagrams under different mass ratios; (B) Tensile strength under different mass ratios; (C) Elongation at break at different mass ratios; (D) Compression stress-strain diagrams under different mass ratios.



**Fig. 4.** Impedance diagrams and conductivity of PS-PC, PS-PCA, and PS-PCA-Ca; Stress-strain diagrams of PS and PS-PC thin films.

### CONCLUSION

A PVA/SA hydrogel was prepared, this dual network hydrogel has a good energy dissipation capacity. After combining with the PC template, the response results to  $\text{Ca}^{2+}$  indicate that PVA/SA-PC thin films have good signal detection ability, and conductive thin films can make small light bulbs emit light. Therefore, these thin films have great potential for development in the field of visual sensing.

### FUTURE WORK / REFERENCES

Zhangyi Qian is pursuing a bachelor degree in Shanghai Polytechnic University (SSPU) and her main subject is the biomedical application of photonic crystal hydrogel. Her mentor is Dr. Cheng Chen, an associate professor of SSPU whose current research interests include functionalization and fabrication of nanomaterials and devices for sensing and biomedical application.

**Related Publications:**  
 Sensors. 2017, 17(1), 182  
 Polymers 2020, 12(3), 625  
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 ACS Appl. Bio Mater. 2022, 243.  
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 Gels. 2024, 10(8), 520