Bioinspired Composite Hydrogels with Layered Fibrous Structures and Programmed Planar-to-Helical Shape Transformations

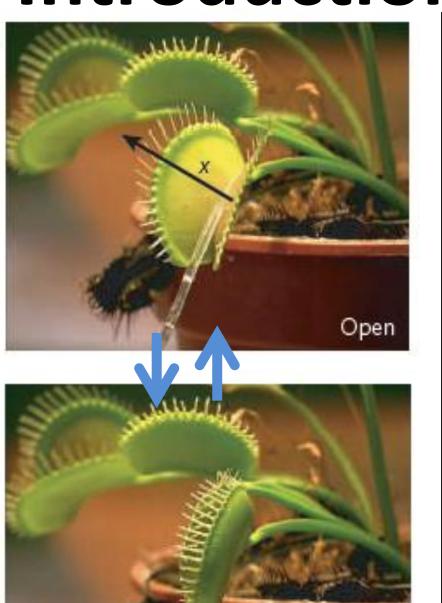


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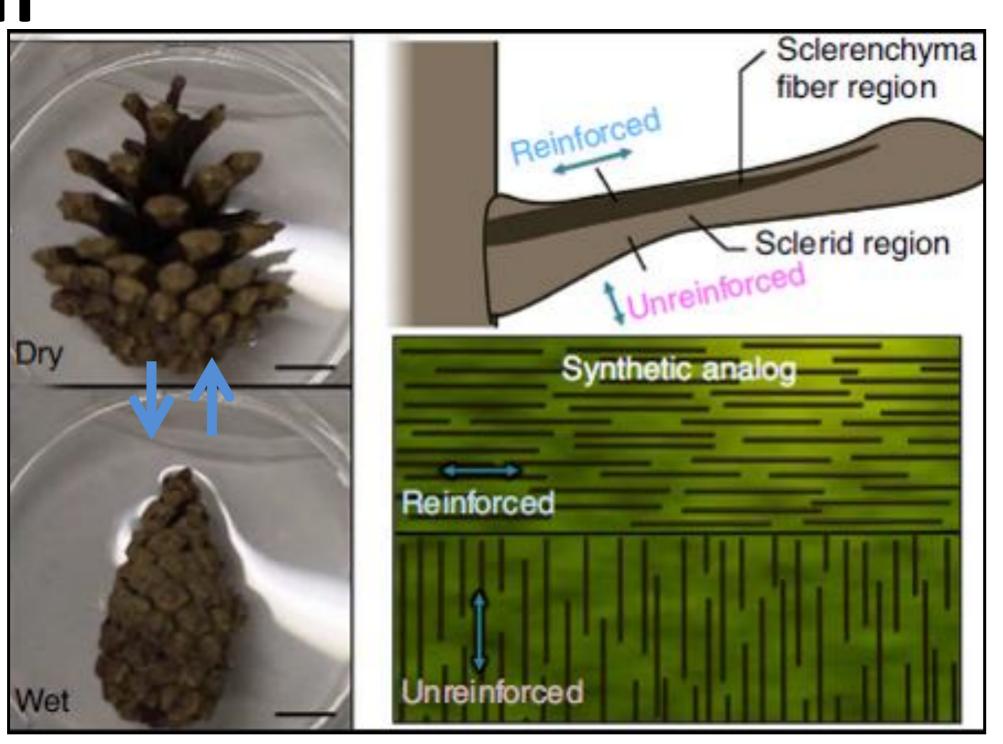


Introduction

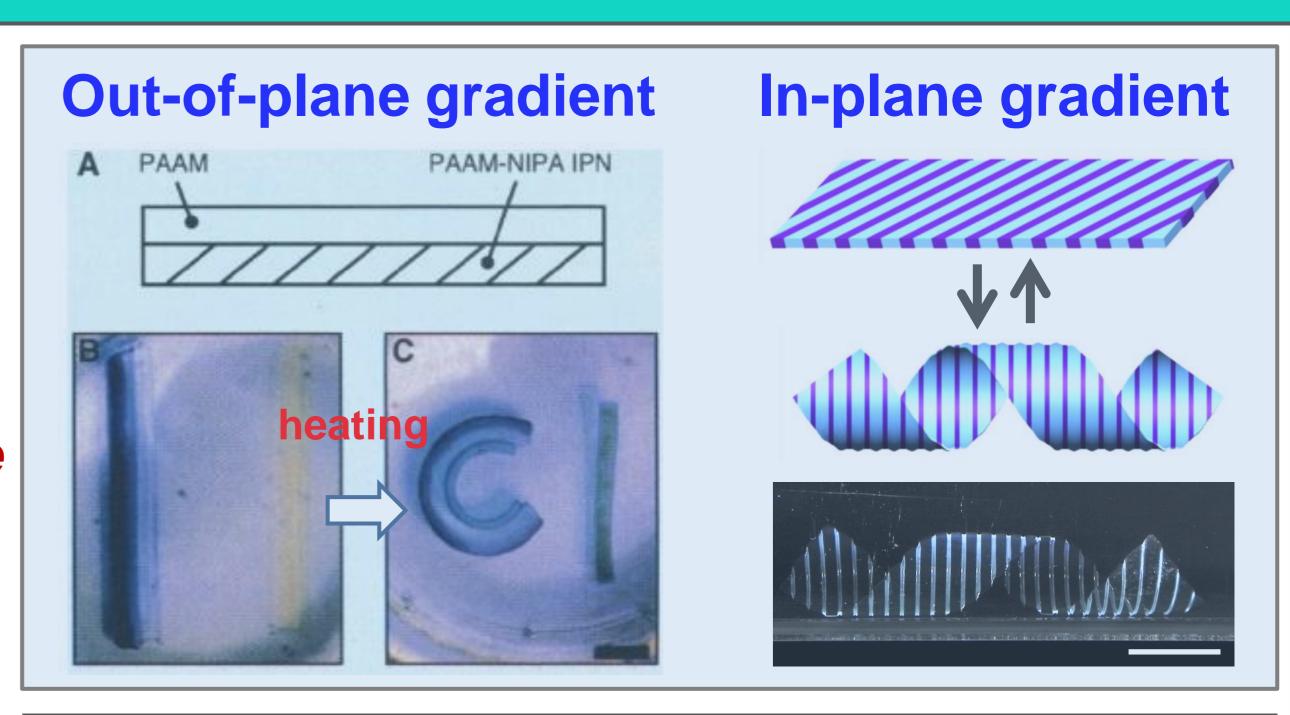


-3.0

α angle (degree)



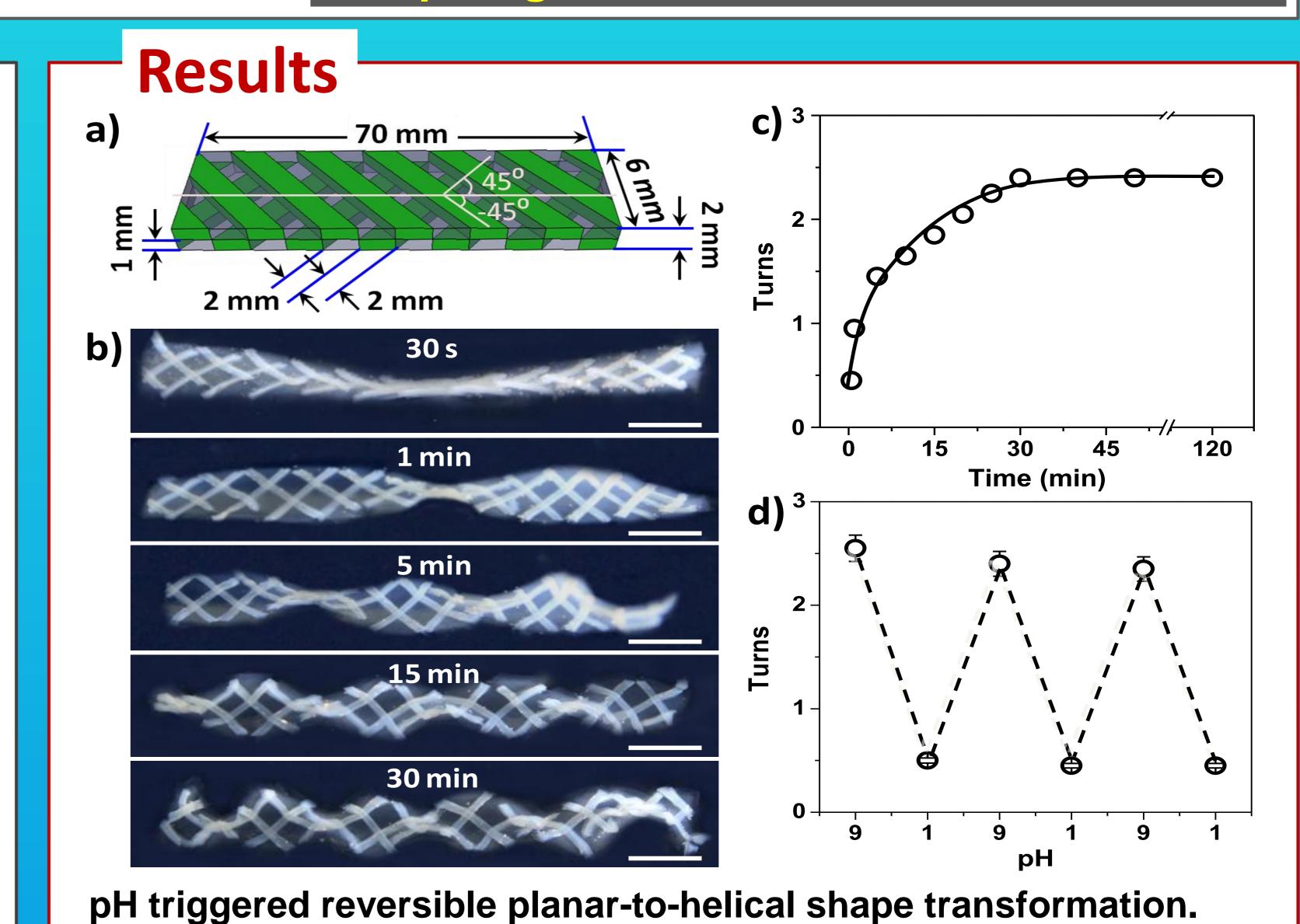
Biomimetic Structure + Response Deformation



Complex gradient structure → Deformation?

Method a) b) c) f) g) poly(acrylic acid) gel poly(acrylic acid) /ploly(N-isopropyl acrylamide) gel

Composite gel fabricated by multi-step photolithography.



a)

Length

5 mm

b)

Width

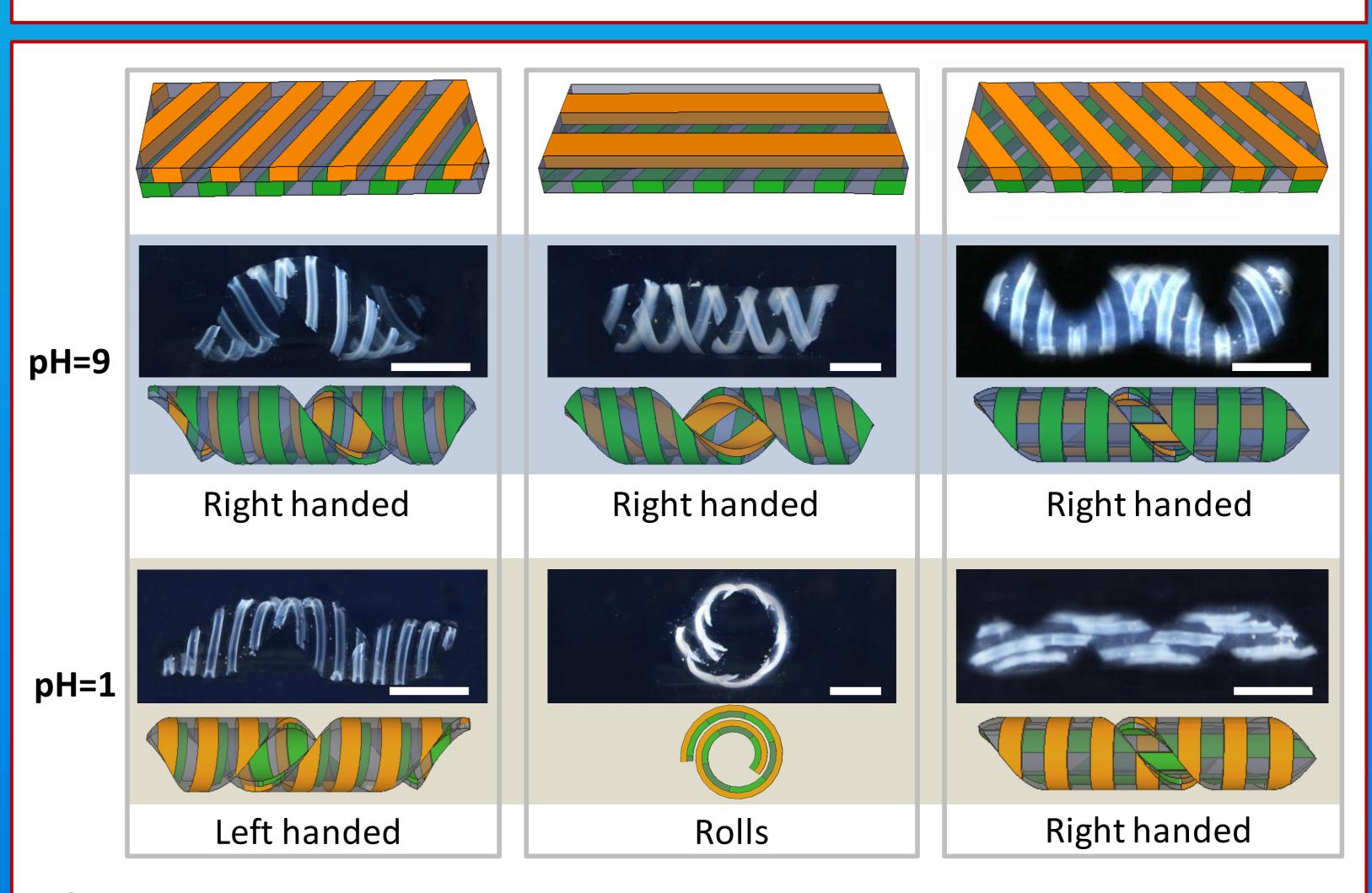
2.5 yell

2.0 yell

3.0 yell

4.5 yel

Effects of gel dimensions and microstructure on final 3D shapes



Shape transformations of composite gels patterned with different responsive polymers

Conclusions

- **♦**Composite gels with both in-plane and out-of-plane gradient structures were fabricated by multi-step photolithography.
- **♦**Twisting deformations and shape transformations have been realized by patterning the gel with parallel stripes in the upper and bottom layers.

References

- [1] S. Armon, E. Efrati, R. Kupferman, E. Sharon, *Science* 2011, 333: 1726.
- [2] R. M. Erb, J. S. Sander, R. Grisch, A. R. Studart, *Nat. Commun.* 2013, 4: 1712.

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 β angle (degree)