

## Biocompatible Composite Hydrogel with On-Demand Swelling-Shrinking Properties for 4D Bioprinting

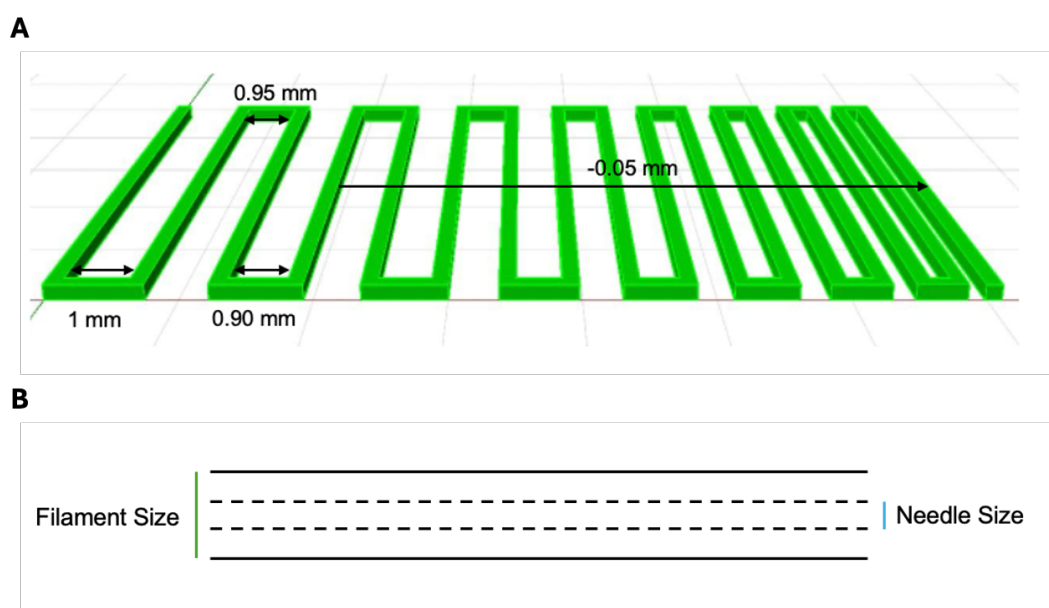
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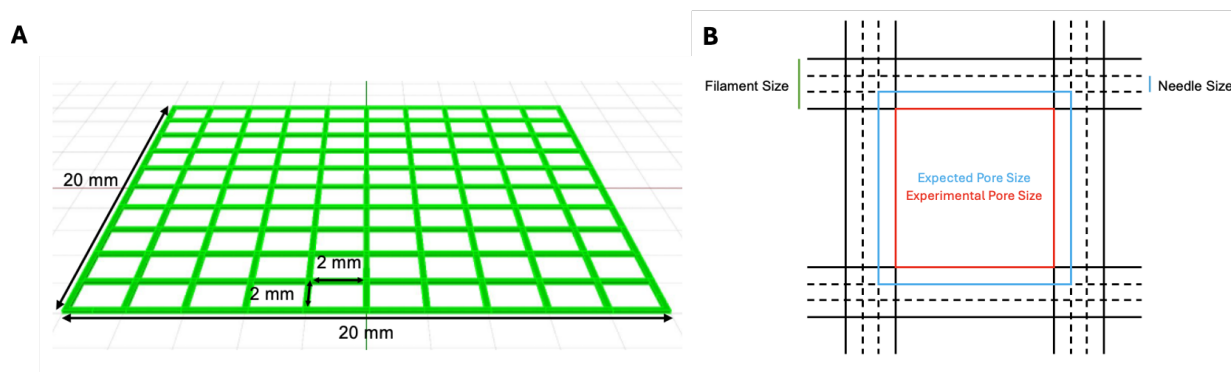
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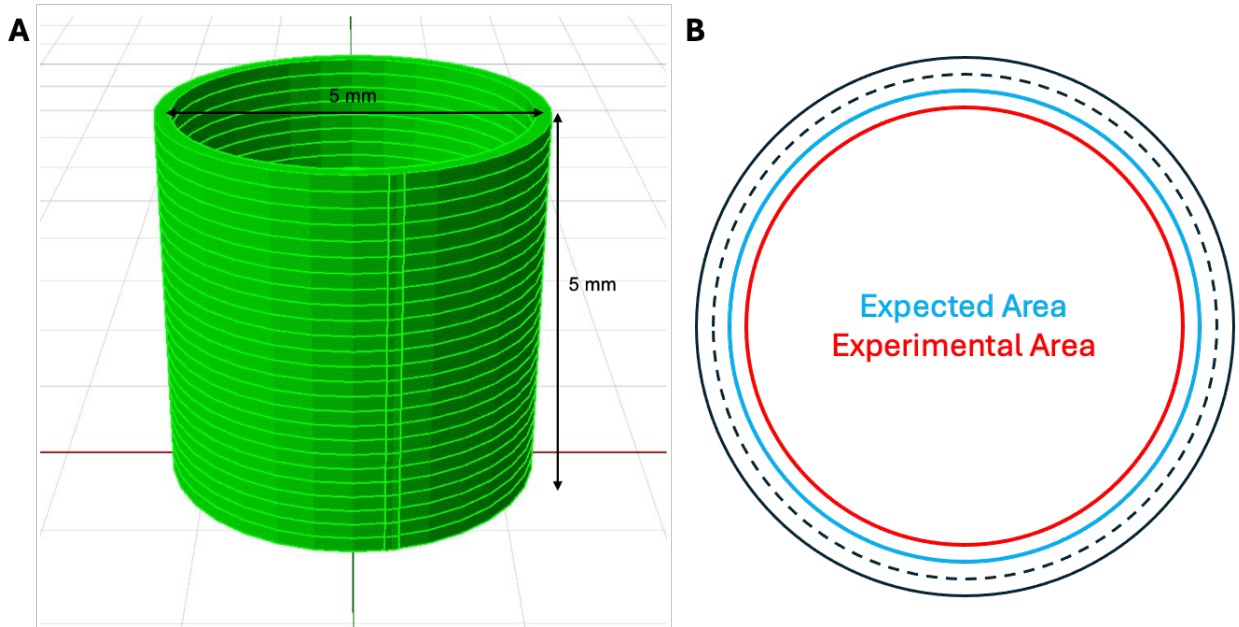
### SUPPLEMENTARY INFORMATION



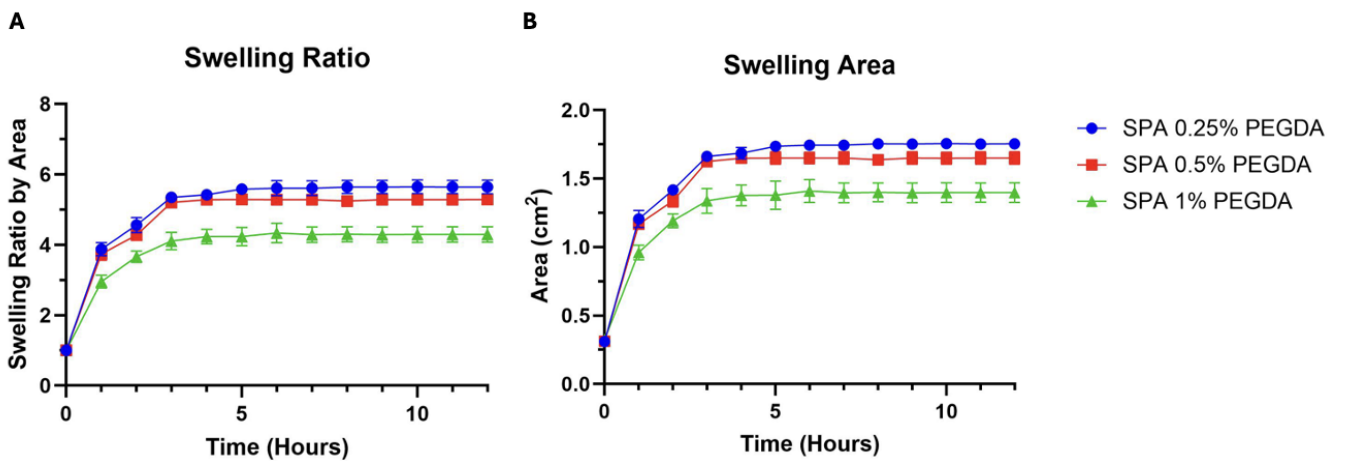
**Supplementary Fig. 1.** Schematic describing the filament fusion test. **(A)** The CAD file measurements and **(B)** an illustration of the needle diameter versus the actual spread of the filament.



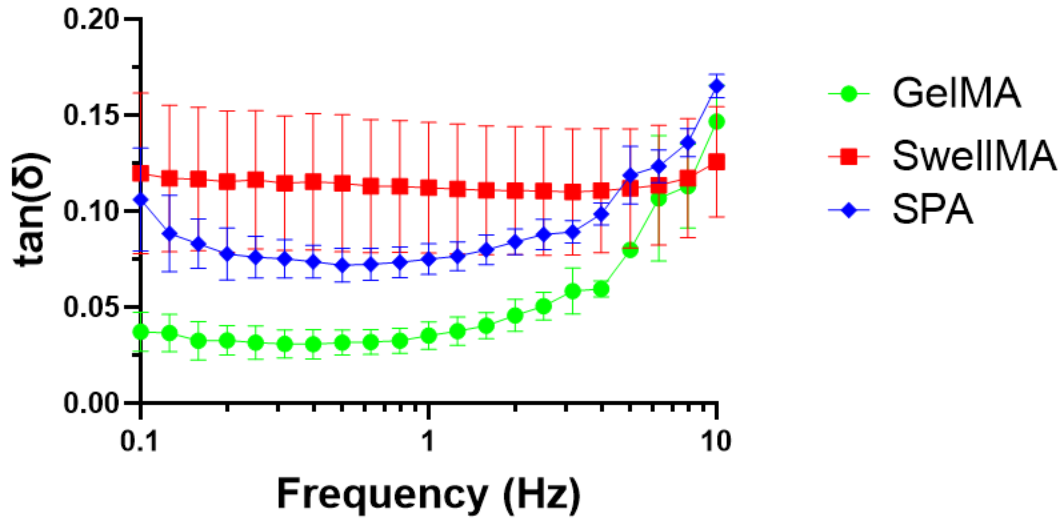
**Supplementary Fig. 2.** Schematic describing the porosity test. **(A)** The CAD file measurements and **(B)** an illustration of the expected pore size versus experimental pore size.



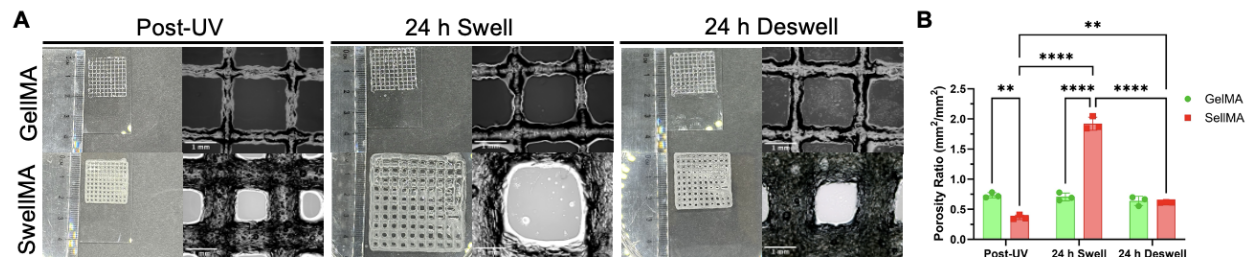
**Supplementary Fig. 3.** Schematic describing the cylinder test. **(A)** The CAD file measurements and **(B)** an illustration of the expected area versus experimental area.



**Supplementary Fig. 4.** Characterization of SPA swelling area over 12 h. **(A)** Swelling ratio by area of SPA with change in PEGDA concentration swelled in DPBS for 12 hours and **(B)** area.



**Supplementary Fig. 5.** Tangent delta ( $\tan(\delta)$ ) of GelMA, SwellIMA, and SPA throughout the frequency sweep rheological assessment. At 1 Hz, SwellIMA exhibits the highest  $\tan(\delta)$  demonstrating its viscoelastic behavior. N = 3, data shown as mean  $\pm$  SD.



**Supplementary Fig. 6.** Porosity print test of SwellIMA and GelMA. **(A)** Macroscopic and microscopic images of the porosity print test for GelMA and SwellIMA with 24 h swell and 24 h deswell. **(B)** Quantification of the porosity ratio. \*\*\*\* Denotes significance ( $p < 0.0001$ ), \*\* ( $p < 0.01$ ), n = 3, data shown as mean  $\pm$  SD.

**Supplementary Video 1 (.mp4 file).**

**Supplementary Video 2 (.mp4 file).**

**Supplementary Video 3 (.mp4 file).**

**Supplementary Video 4 (.mp4 file).**