ADVANCED MATERIALS TECHNOLOGIES

Supporting Information

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Stereolithography for Personalized Left Atrial Appendage Occluders

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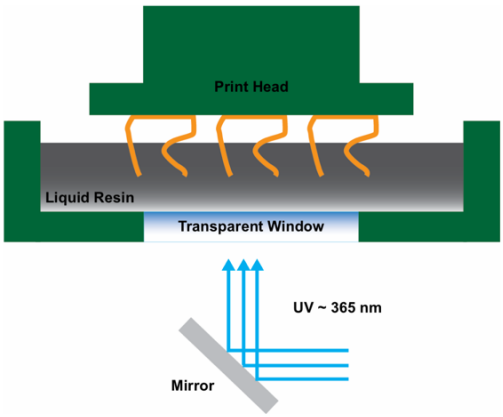


Figure S1. Schematic of stereolithography printing process. Printed parts are cured layer by layer after exposure to UV light. Printed parts are pulled out of the liquid resin.

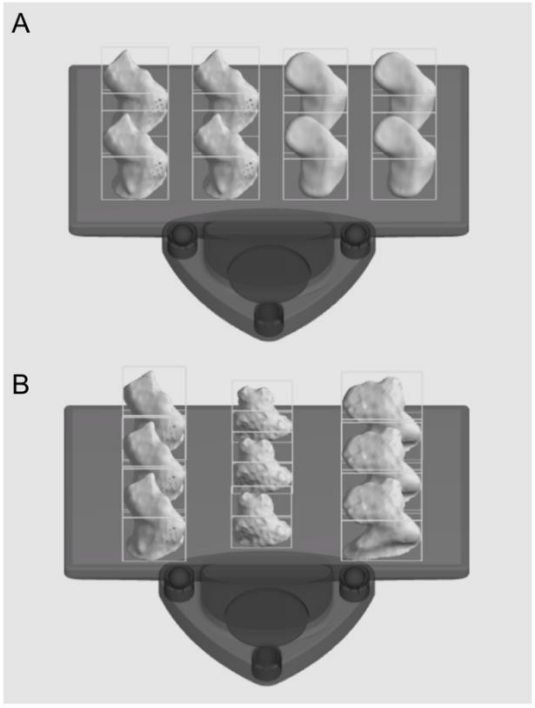


Figure S2. Schematic of LAA occluders on print head. (a) Complex features, or smooth parts for the same patient can be printed on a single print. (b) LAA occluders for 3+ different patients can be fabricated on a single print.

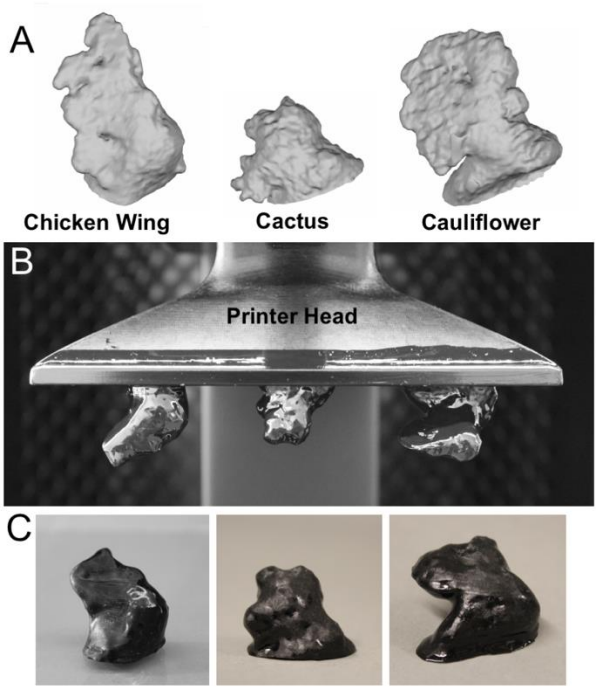


Figure S3. Multiple patient-specific occluders can be printed simultaneously. (a) CAD renderings of CT segmented LAA for three typically encountered LAA morphologies, Chicken Wing (CW), Cactus, and Cauliflower. (b) 3D printed morphologies *green bodies*. (c) Fully cured LAA occluders for three patient morphologies.

Figure S4. Pressure – volume test set-up. Occluders were attached through their plug onto the tip of a 30 gauge needle. They were then inflated with air up to 60 mL (size of syringe) while the volume input and pressure output was being recorded in LabVIEW VI. Each sample (n = 7) was tested five times and the 5th recording was used to determine the mean pressure and standard deviation of the samples.

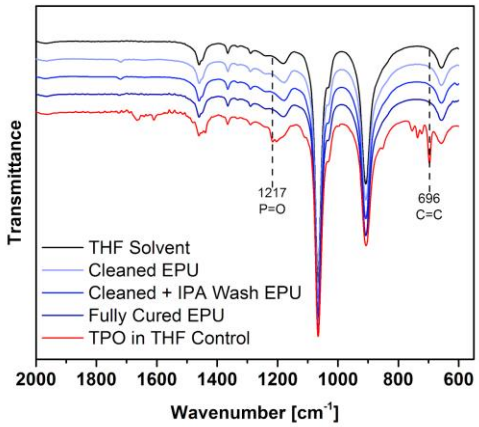


Figure S5. Fourier-Transform Infrared Spectroscopy on printed EPU samples. Three EPU prints, post-processed to varying degrees, were swelled in tetrahydrofuran (THF) for 48 hours. The spectra for the resulting solvent leachate is depicted here. A control containing TPO, the predominant photoinitiator compound in the EPU resin, shows characteristic peaks at 696 cm^{-1} and 1217 cm^{-1}, denoting C=C and P=O bonds respectively.

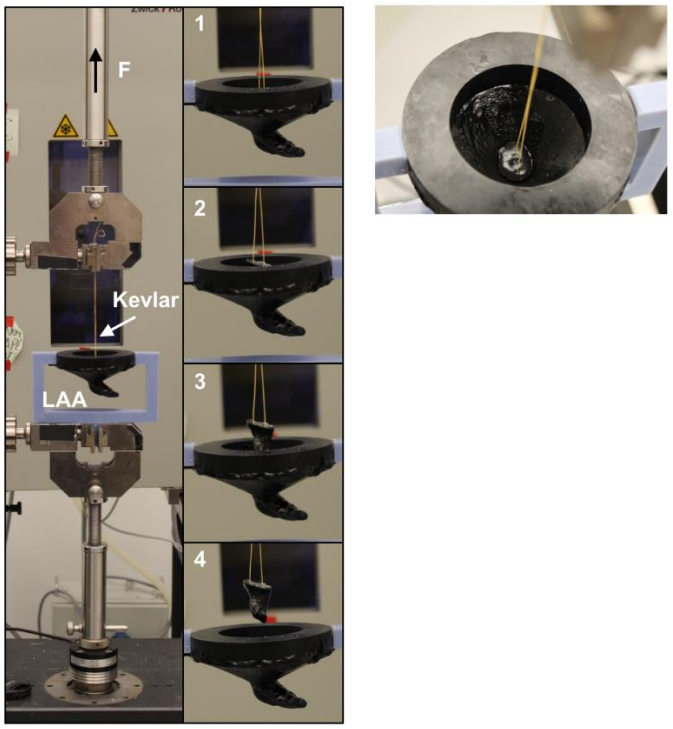


Figure S6. Pull-out test. Kevlar thread (yellow) was looped through the ostial surface of the occluders and then attached to the upper crosshead of the tensile tester. The 3D printed LAA test-jig was attached to the bottom grip of the tensile tester. Occluders (which were prefilled with Ecoflex 00-30) were inserted into the LAA and then pulled out. (1-4) Images of the various stages of the test.

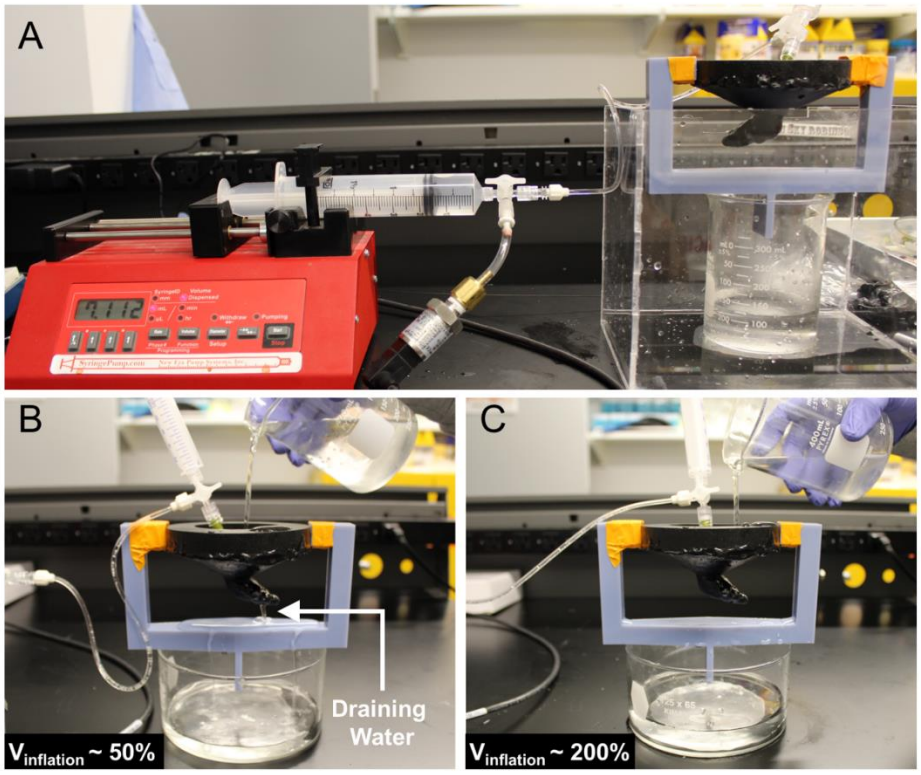
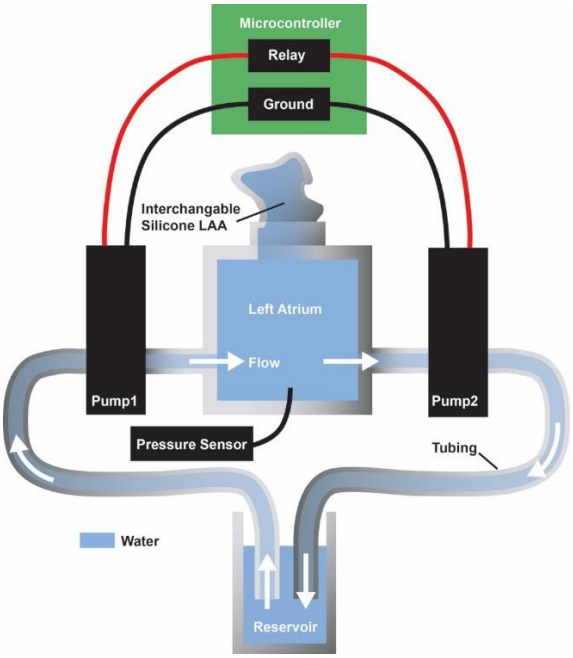


Figure S7. Occlusion Volume Testing Setup. (a) A deflated P-S occluder was inserted into a 3D printed LAA and slowly infused with water. (b) The occlusion volume of the occluder was determined by pouring water into the LAA, where it drained around the inflating occluder and through a hole in the distal tip. (c) When the water stopped flowing through this hole, the P-S device was determined to be fully occluding the LAA.



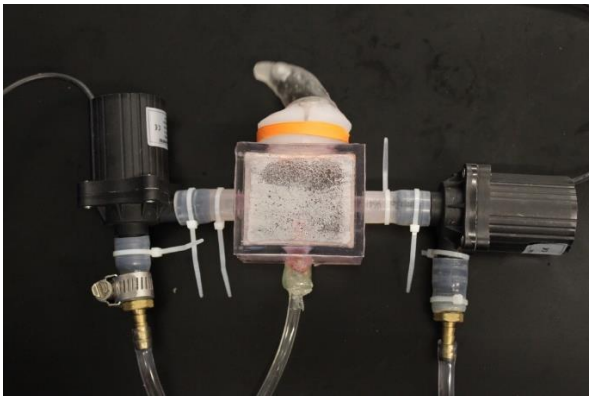


Figure S8. Embolism test set-up. Pumping water at physiological frequencies f = 1Hz. Measuring pressure within the idealized left atrium. Reservoir sits ~ 15” below left atrium chamber.

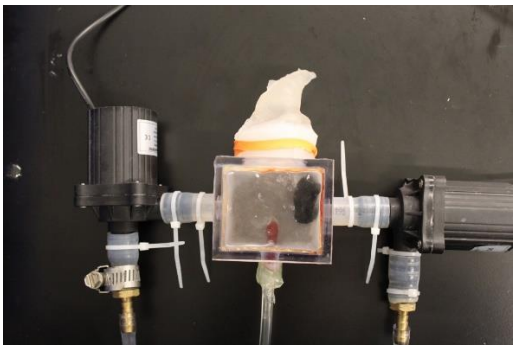


Figure S9. P-S and spherical occluders embolized when they were underinflated, $V_{inflation}$ ~ 50%. In this image the P-S occluder is visible within the idealized left atrium of the flow set up. This demonstrates embolism of a device.

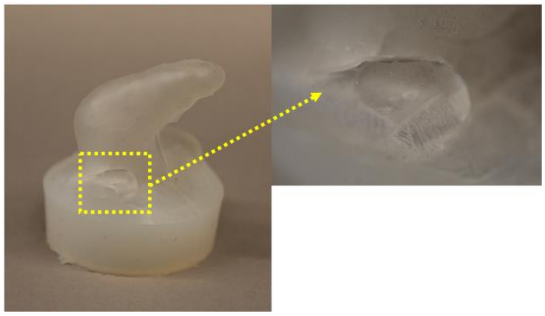


Figure S10. Image of hole that was torn in the silicone phantom LAA by the $V_{inflation}$ ~ *200%* spherical occluder during the first 24 hours of testing.

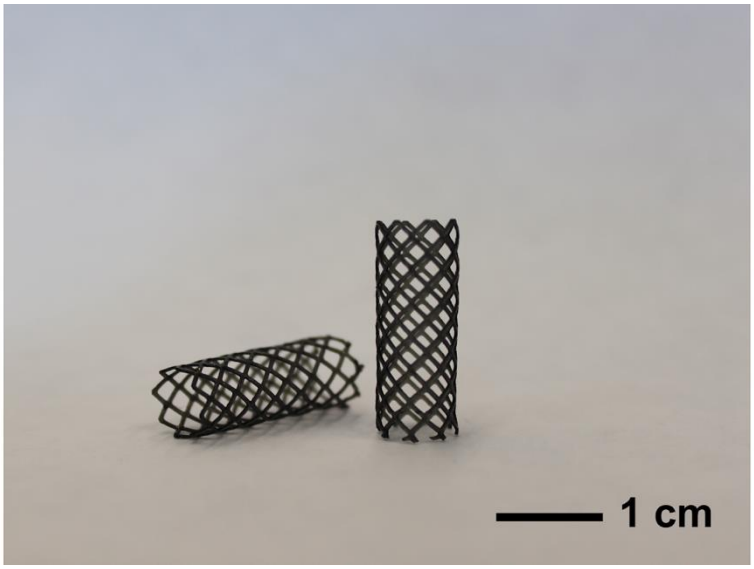


Figure S11: Photograph of 3D printed stents.