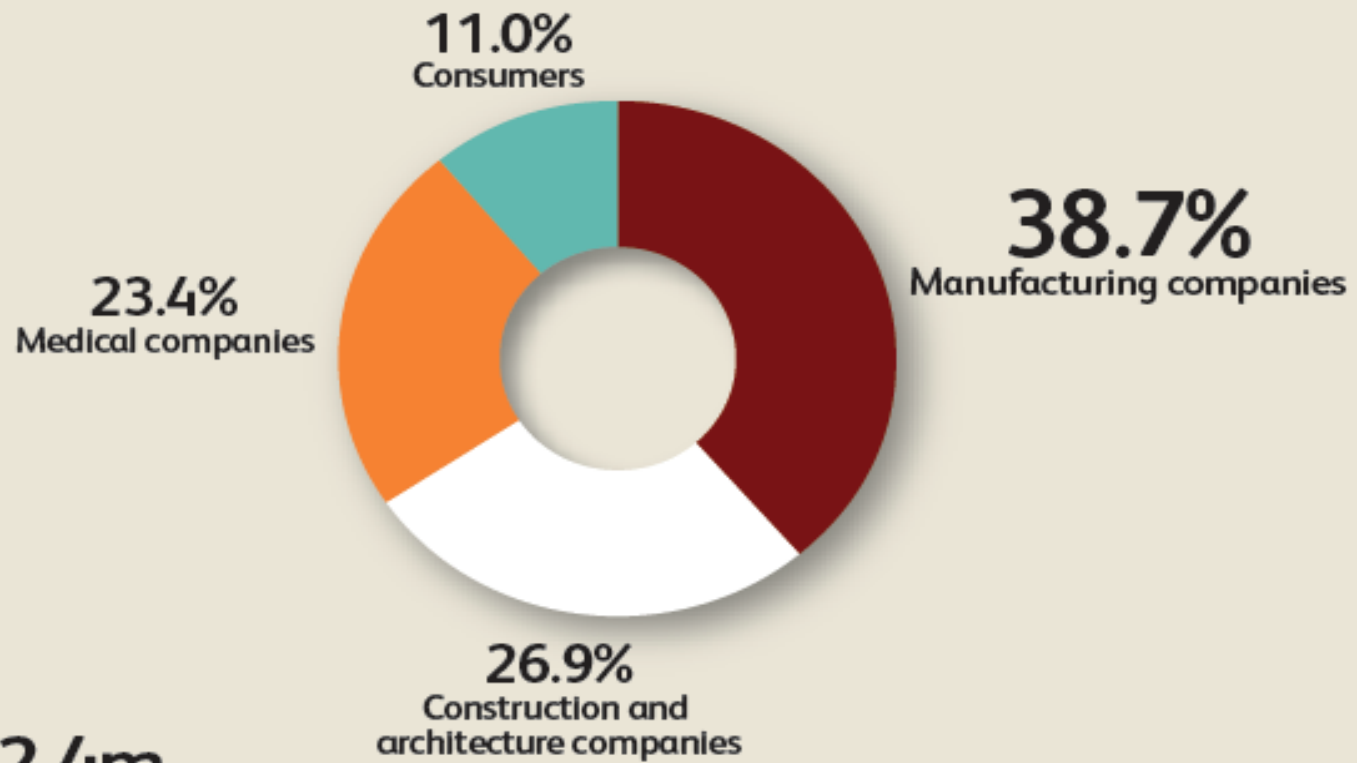


Advanced Materials for the Additive Manufacturing of Machines

ORL : Organic Robotics Laboratory

Robert Shepherd

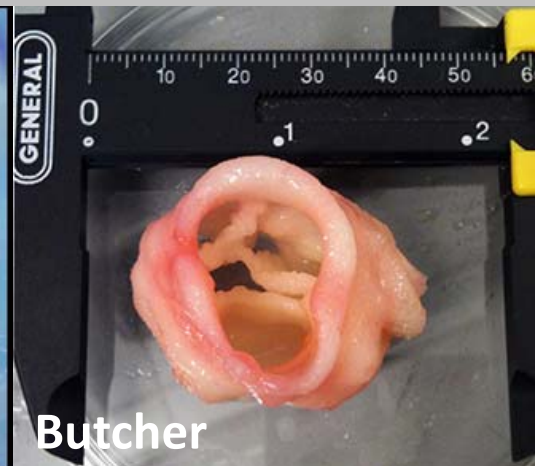
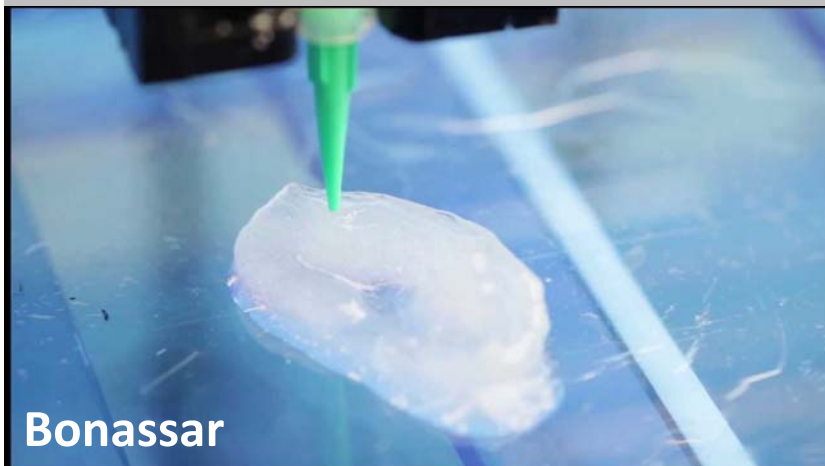
Major market segmentation (2015)

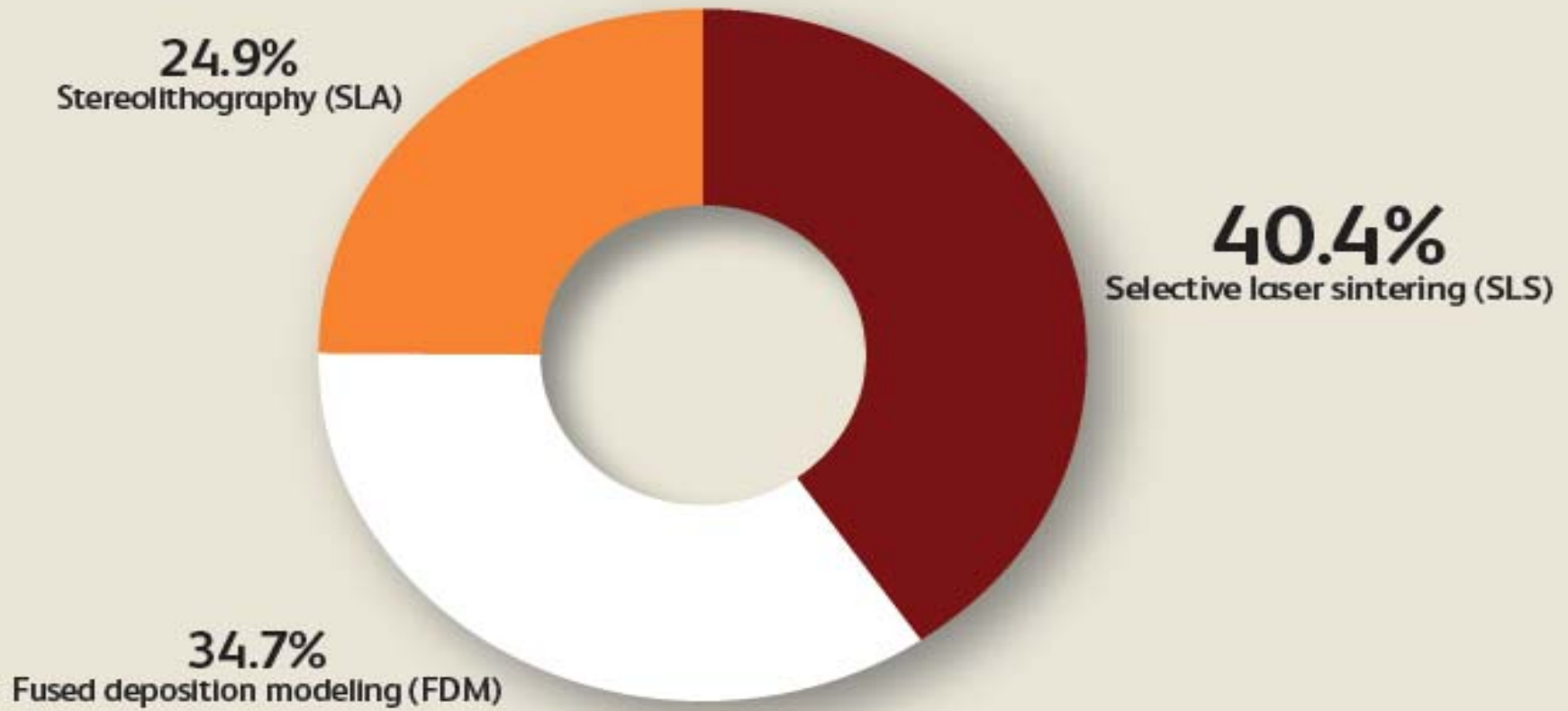


Total \$492.4m

SOURCE: WWW.IBISWORLD.COM

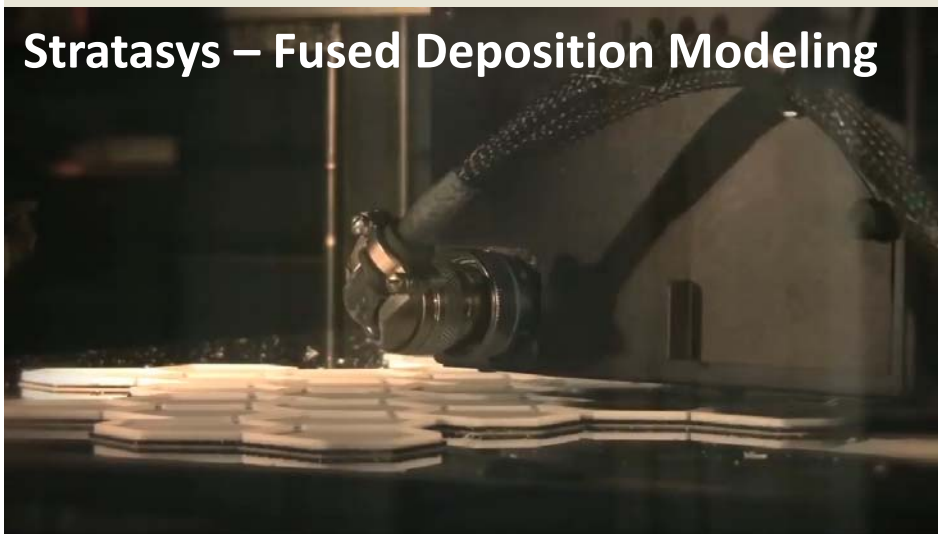
Biomedical Device Printing @ Cornell



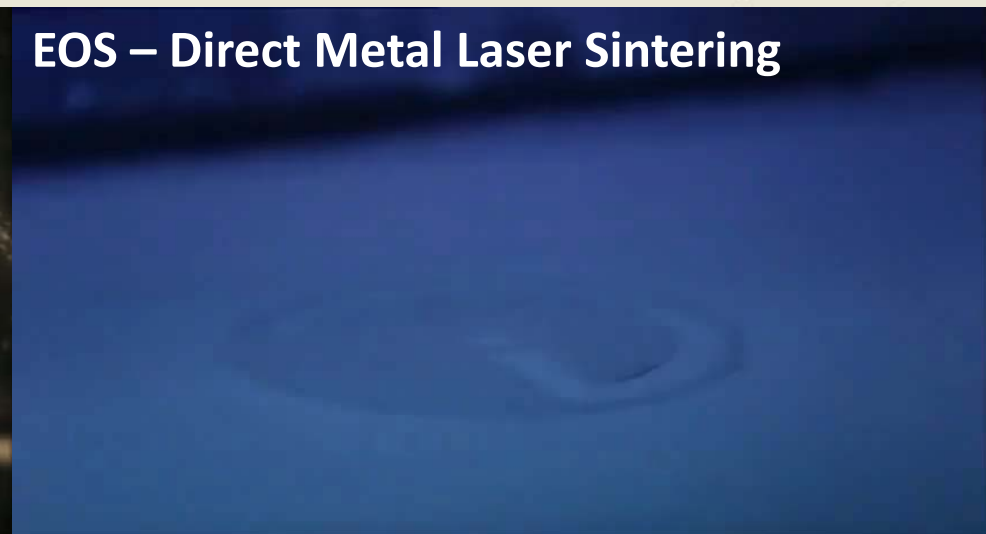


SOURCE: WWW.IBISWORLD.COM

Stratasys – Fused Deposition Modeling



EOS – Direct Metal Laser Sintering



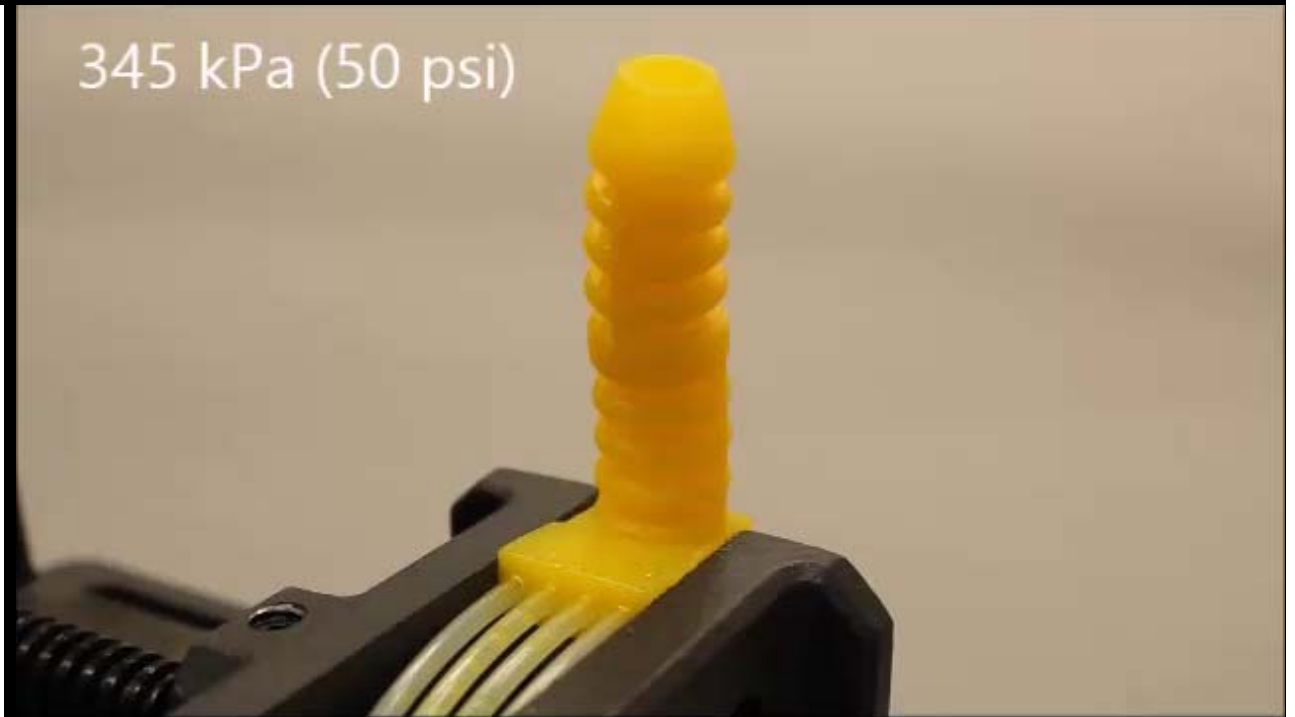
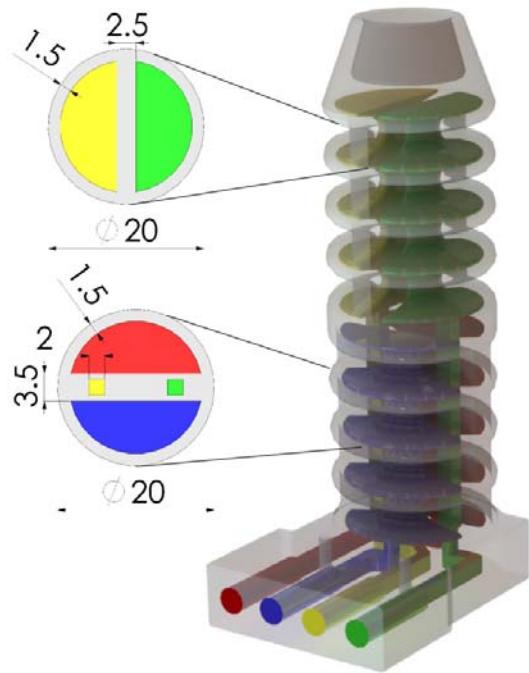
Stereolithography

Carbon 3D, Inc.



- 3D printing via chemistry
- Fastest 3D printer
- No layering effect – monolithic part production

3D Printing Machines



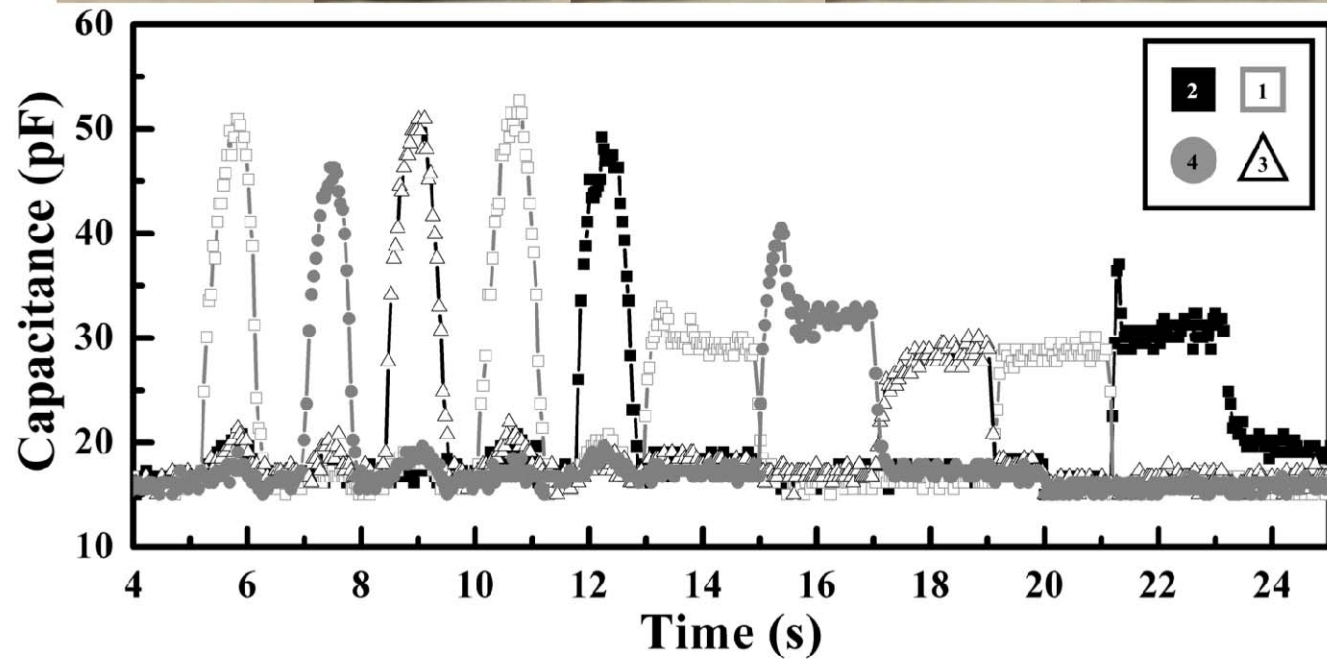
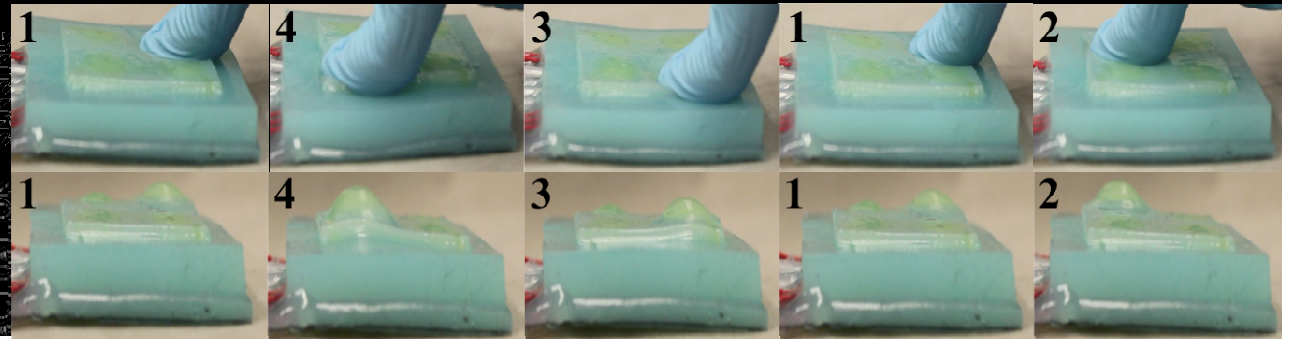
*Peele, et al. Bioinspiration & Biomimetics (2015)

3D Printing Sensors

Transparent, Insulating Rubber



Transparent, Conductive Rubber



*Robinson, et al. Extreme Mechanics Letters (2015)

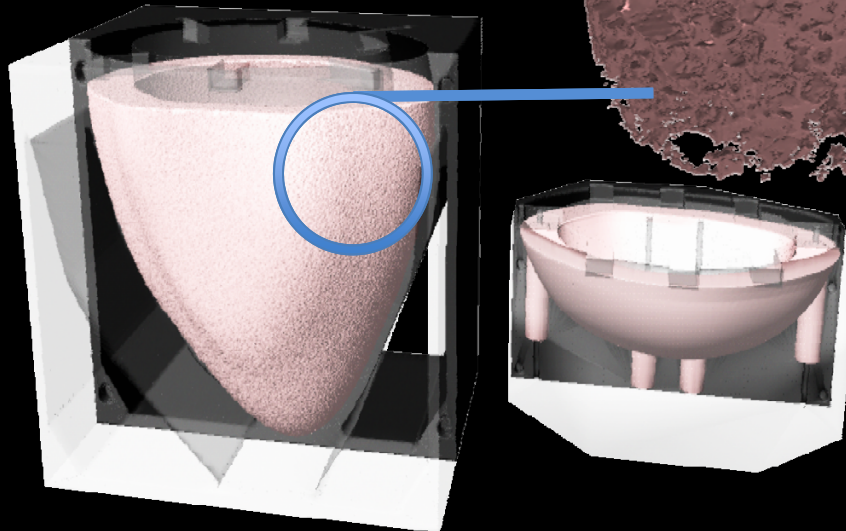
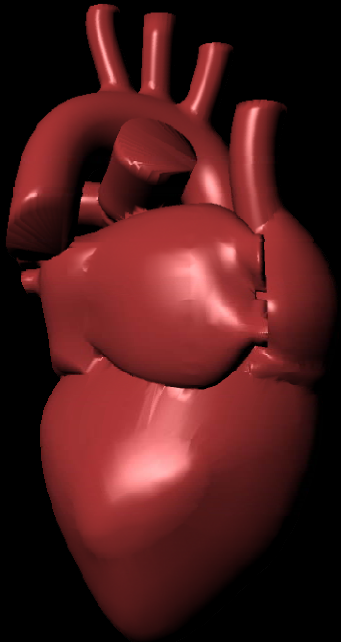
3D Printing Sensors Onto Actuators



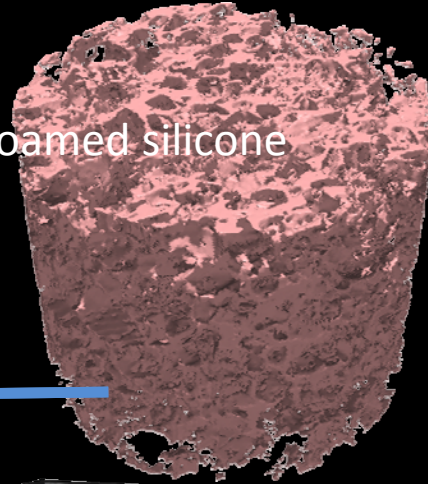
*Robinson, et al. Extreme Mechanics Letters (2015)

Additive manufacturing of foam hearts

Digital heart model

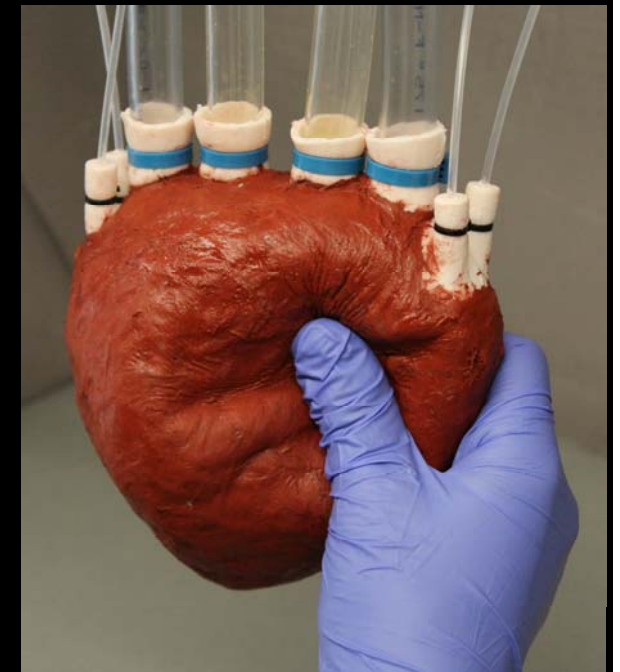


*CT scan of foamed silicone

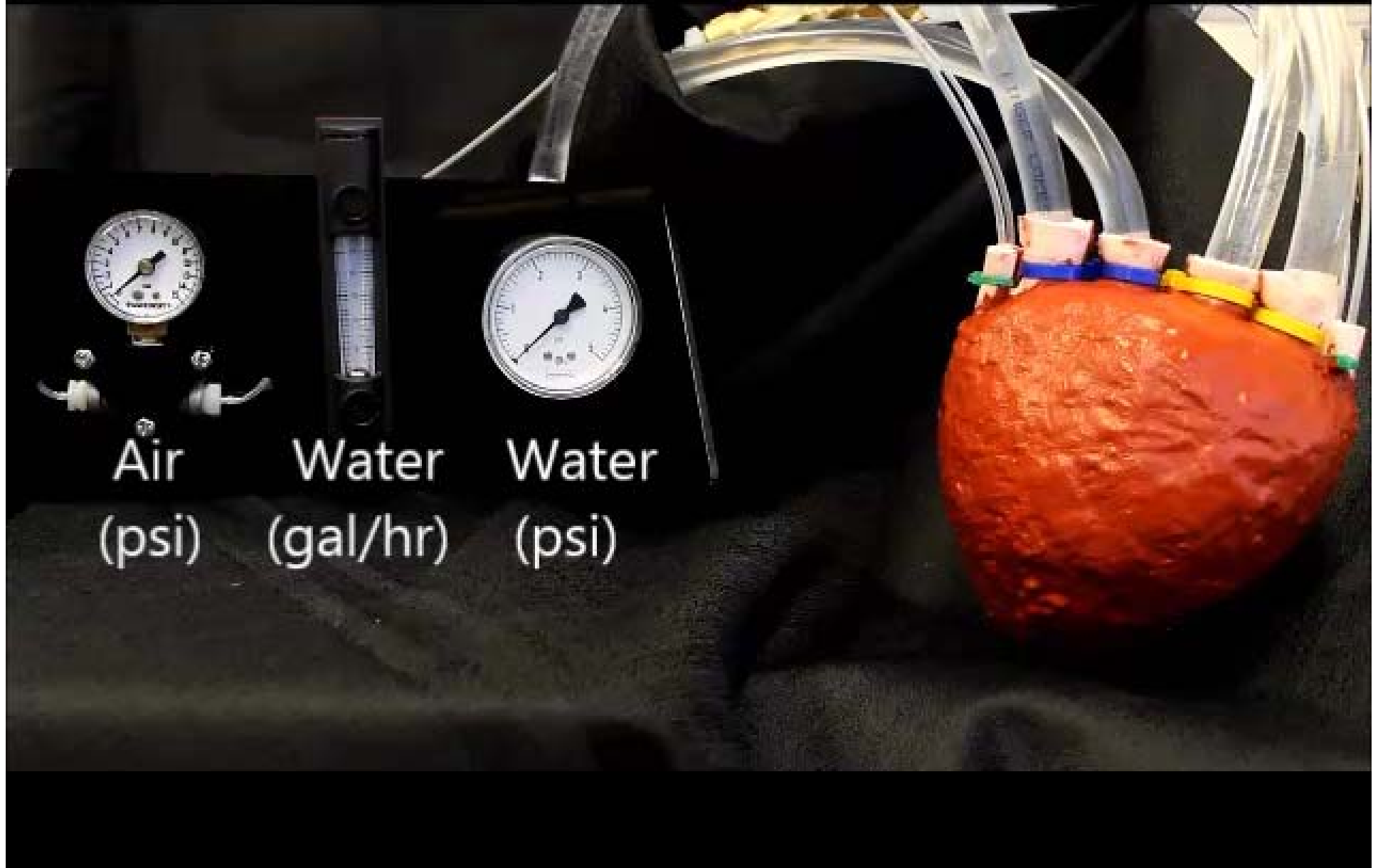


3D Printed mold of heart and foam casting

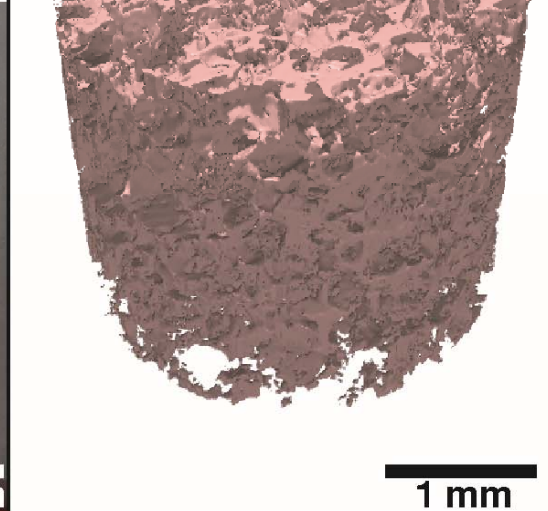
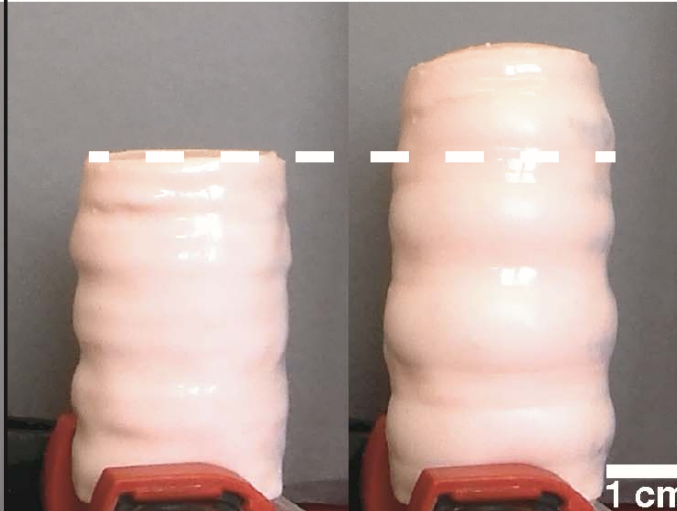
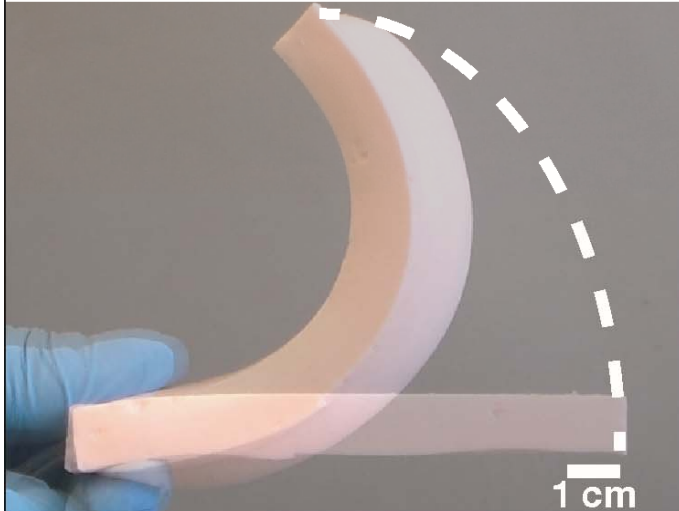
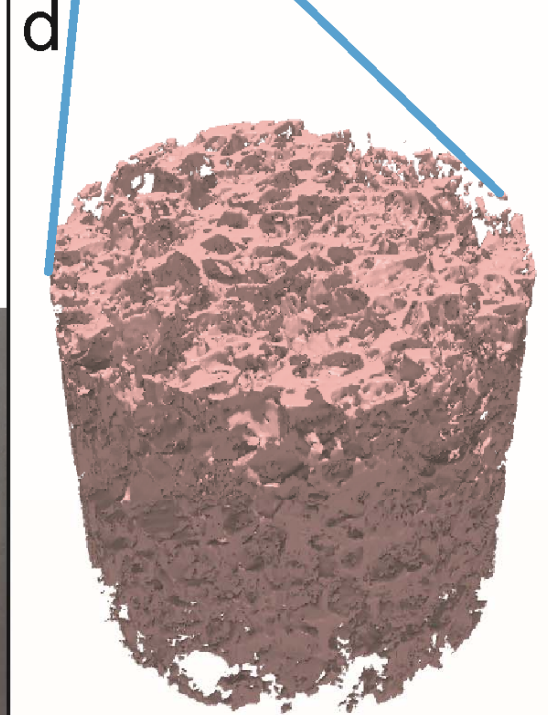
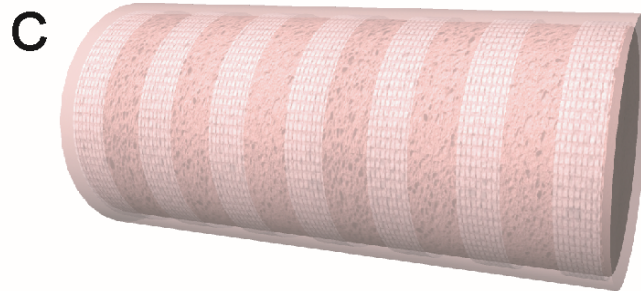
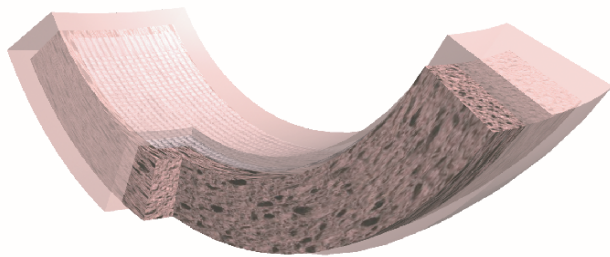
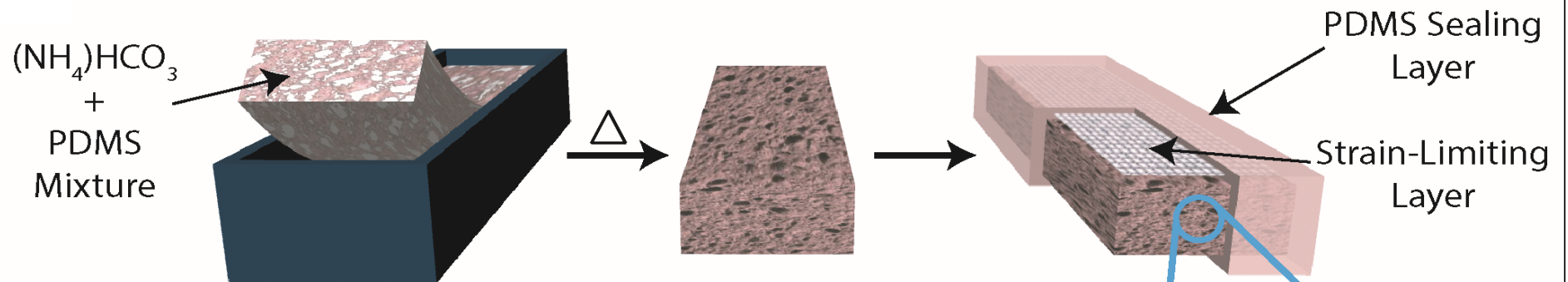
Assembled heart pump



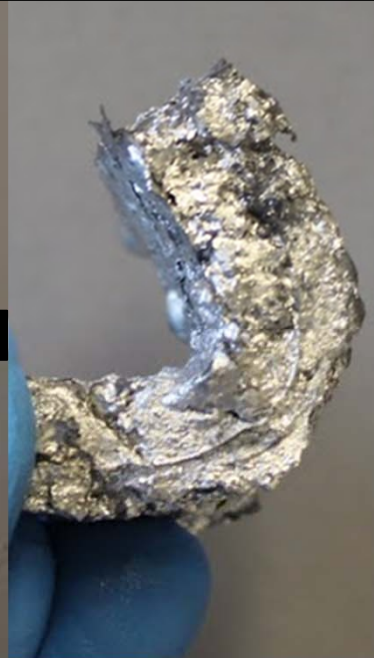
3D printing synthetic biomedical machines



Casting foams for soft machines

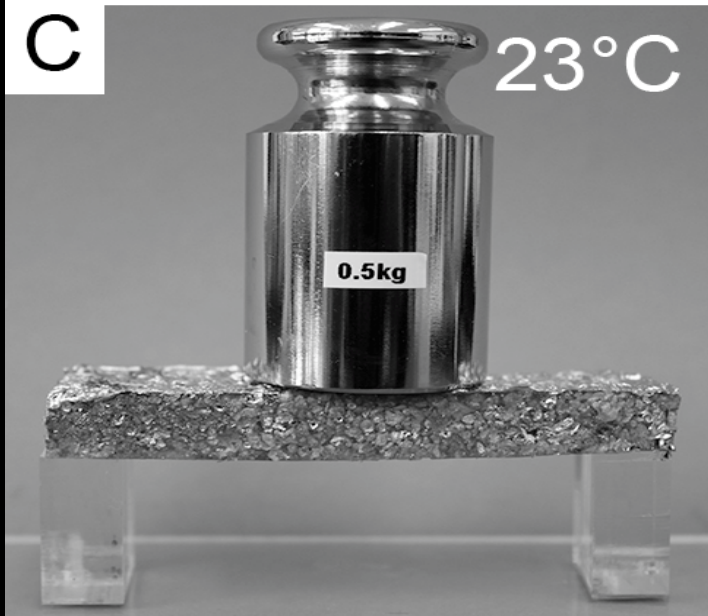


Self Healing, Shape Morphing Metal Machines

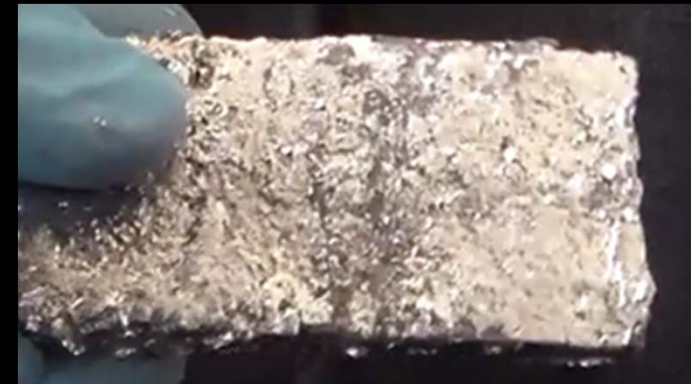
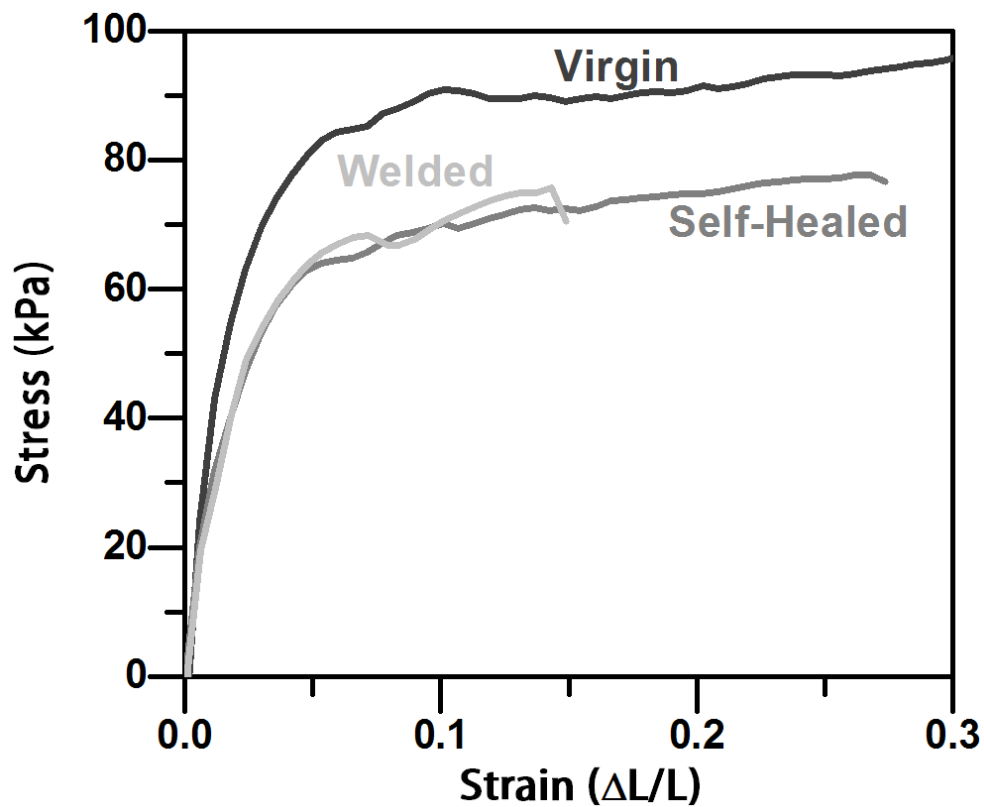
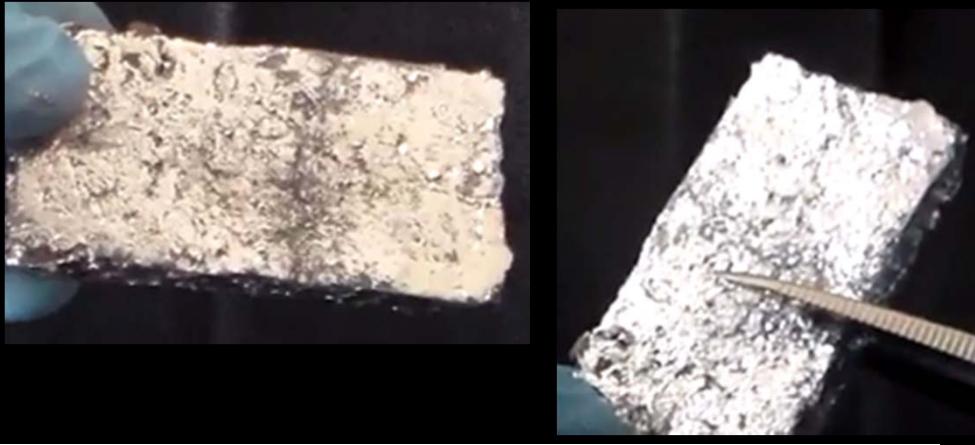


*van Meerbeek, in preparation (2015)

Self Healing, Shape Morphing Metal Machines



Self Healing, Shape Morphing Metal Machines



Acknowledgements

