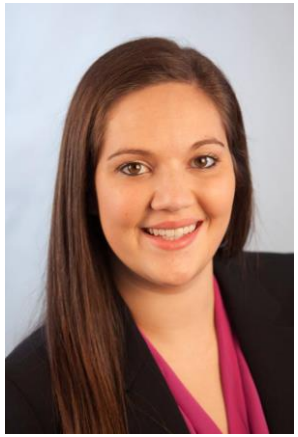
Virtual Design Review #4

Air Force Research Lab (AFRL)
Polymer Infiltration Device

Haimowitz, Jenkins, Kent

The Team

Catherine Kent
Lead ME/Research Coordinator



Emily Stern
Lead Technologist

Michael Haimowitz
Team Leader

James Jenkins
Geometric Integrator

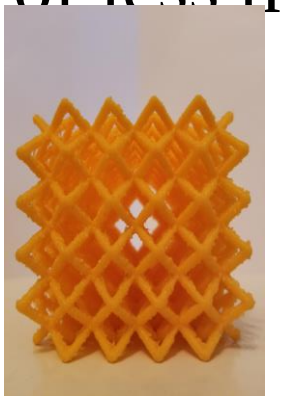
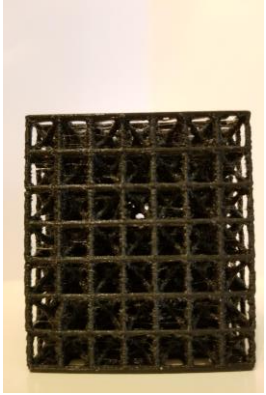
Project Review

Mike Haimowitz

Project Scope

- Design and build a prototype to infiltrate open-cell lattice structures with silicone
- Evenly fill the lattices
- Eliminate air voids
- Achieve porosity of less than 1%




Semester Review

- Ordered silicone for testing
- Ordered PLA to start printing lattices
- Met with project stakeholders for design critique
  - Dr. Hellstrom
  - Dr. Okoli
- Dimension finalization of device components
- Ordered parts for Prototype I

Project Status

James Jenkins

Design Breakdown

- Dual ball valve control for pressure release when degassing silicone.
- Pressure gauge to monitor for faulty seals.
- Funnel to aid in flow, limit silicone waste, and easy cleanup/disposal.
- Square drilled base for adaptive base.

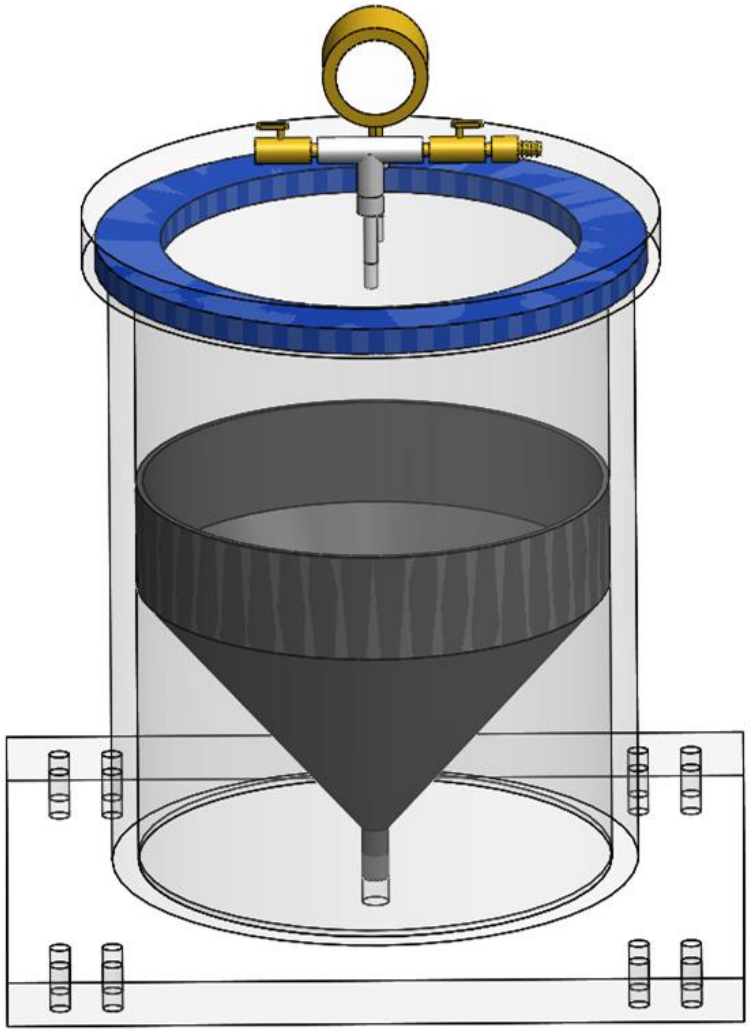


Figure 1. Vacuum chamber assembly.

Cubic Jig

- Top and bottom of jig are rubber to hold a strong seal against acrylic walls.
- Edges are milled for flat surface seal.
- Hot glue used at seams to create a seal.

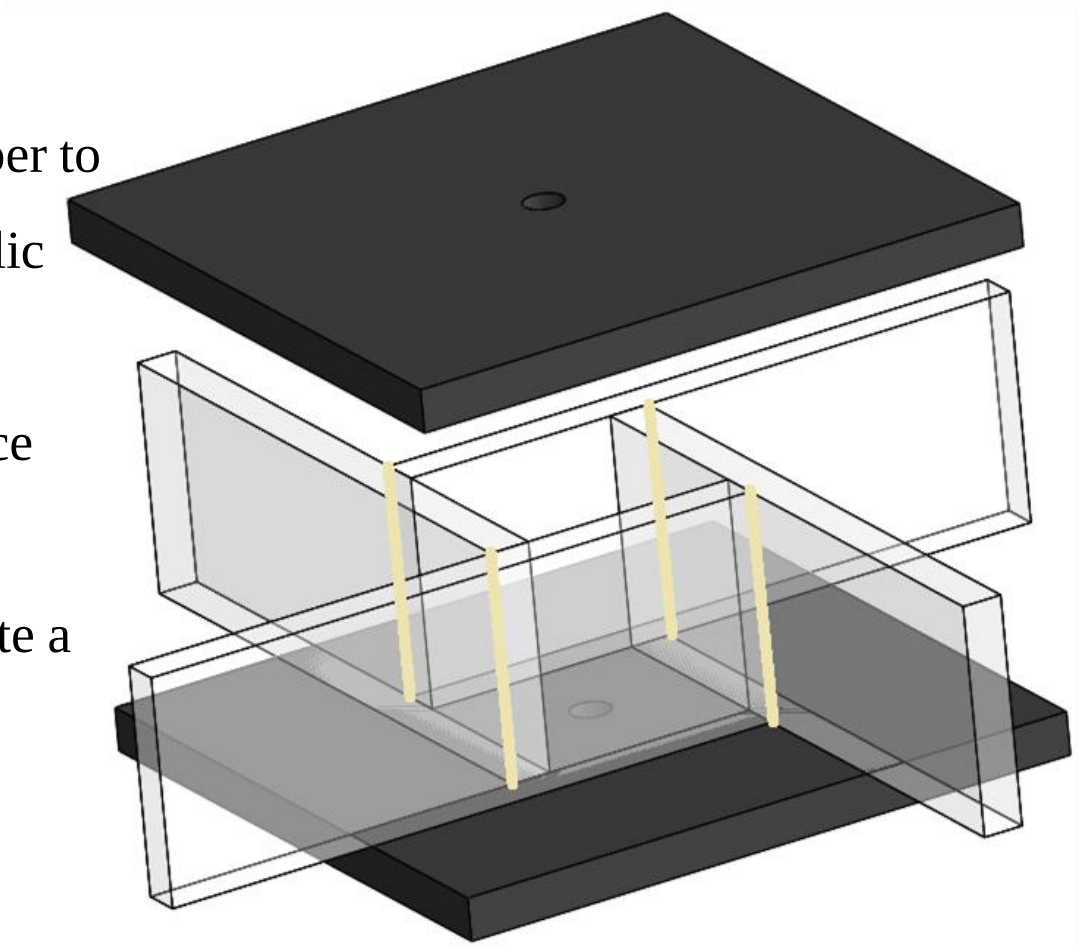


Figure 2. Jig used for filling cubic lattices.

Cylindrical Jig

- Similar to the cubic jig, the top and bottom mats are rubber.
- Acrylic sides are held together by glue/silicone.
- Use of a release agent in order to remove the jig sides cleanly.

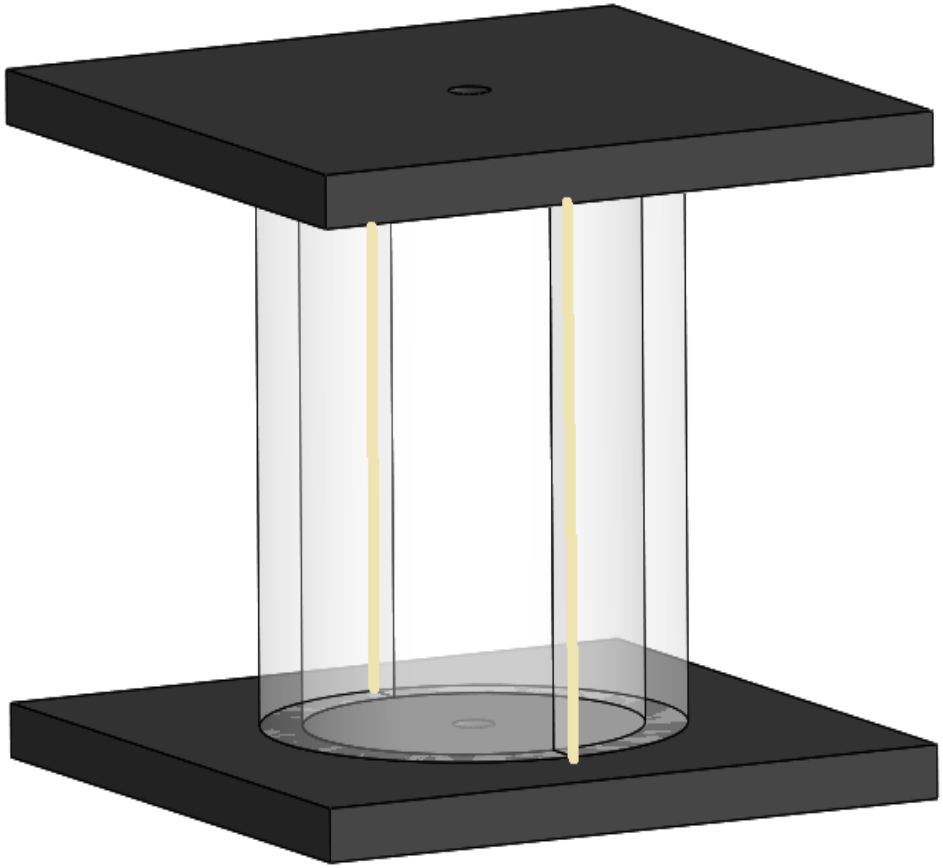


Figure 3. Jig used for filling cylindrical lattices.

Catch Can

- Located in-line between the jig and vacuum pump.
- Allows excess silicone to drop into the catch can instead of being pulled into the vacuum pump.

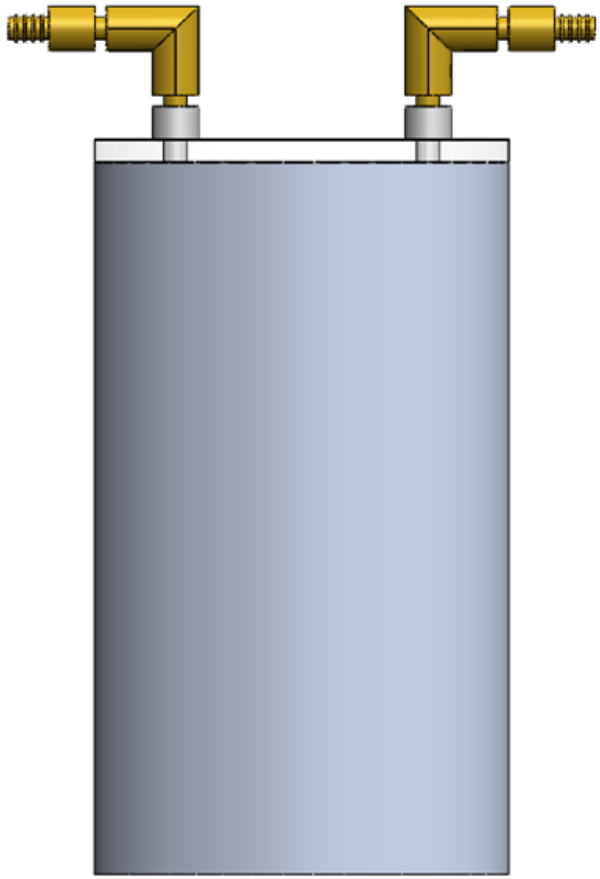


Figure 4. Catch Can.

Additional Equipment

Tubing and Gum Tape

Tubing transports silicone from vacuum chamber to the jig. Tape ensure strong seal.

Figure 5. Gum tape applied to vacuum tubing.

Silicone Line Clamps

External line clamps will restrict the flow of silicone without getting plugged up.

Figure 6. Line clamp being used to slow fluid flow.

Prototype Operation

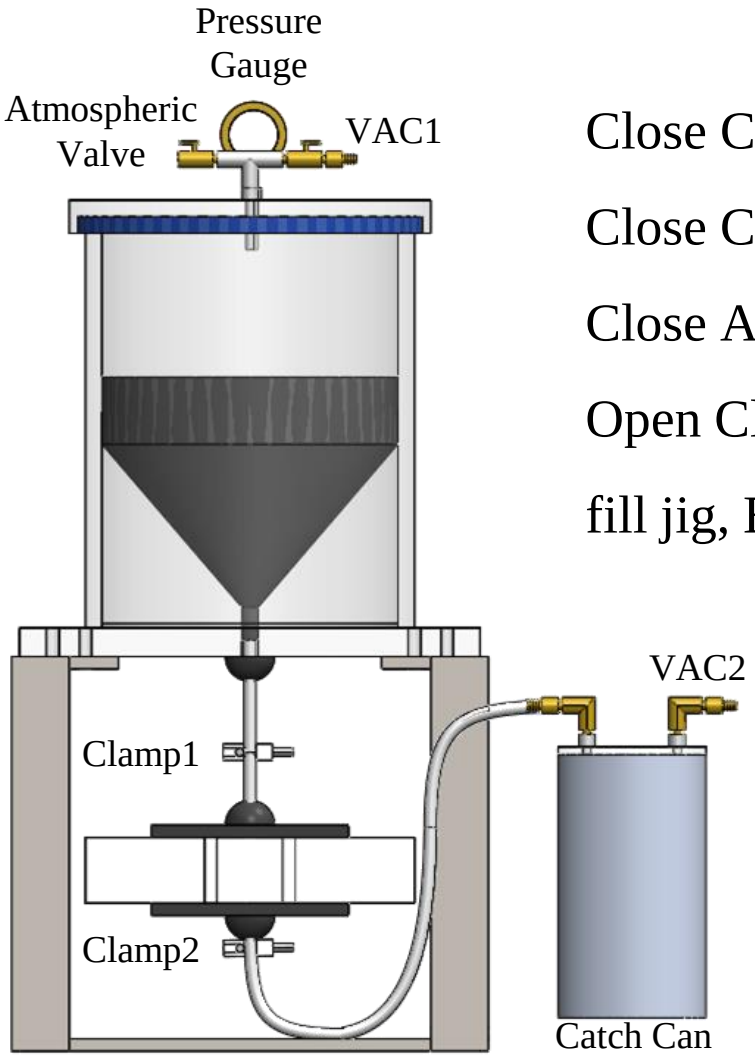


Figure 7. Full Assembly of infiltration prototype.

Close Clamp2, Evacuate tank and jig via VAC1.

Close Clamp1, Open Atmospheric Valve, Add silicone.

Close Atmospheric Valve, Degas via VAC1.

Open Clamp1, Open Atmospheric Valve, Allow silicone to fill jig, Evacuate Catch Can via VAC2.

5. Open Clamp2, Allow silicone to flow through jig into Catch Can.
6. Close Clamp1 and Clamp2, Detach jig, Allow silicone to cure.

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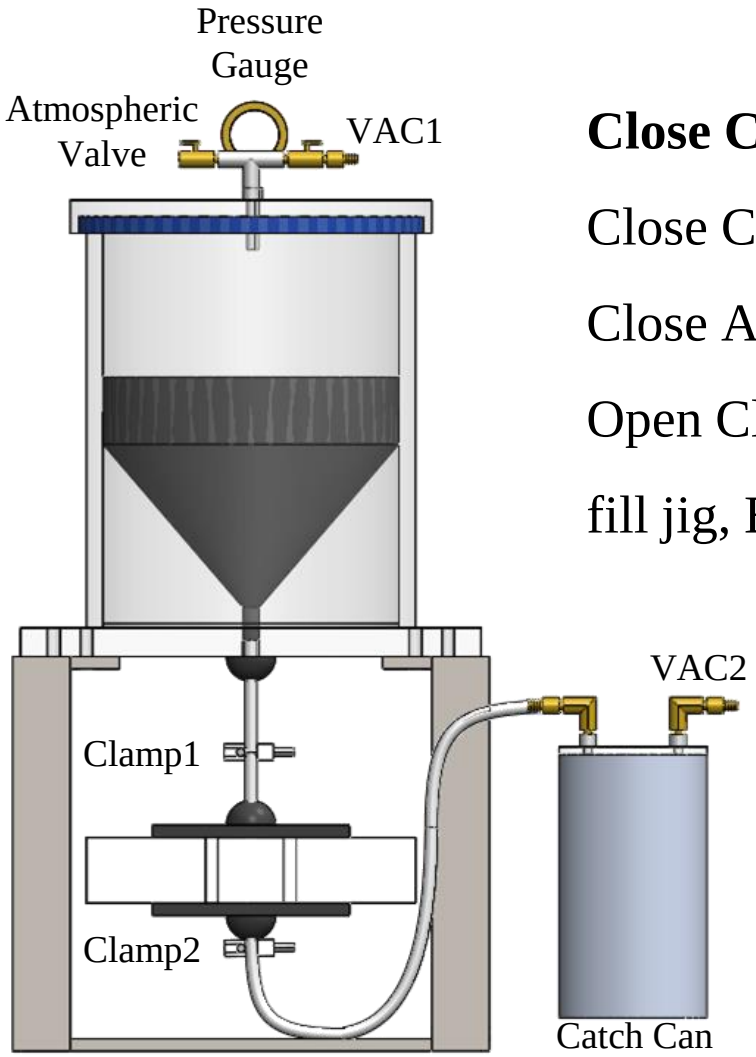

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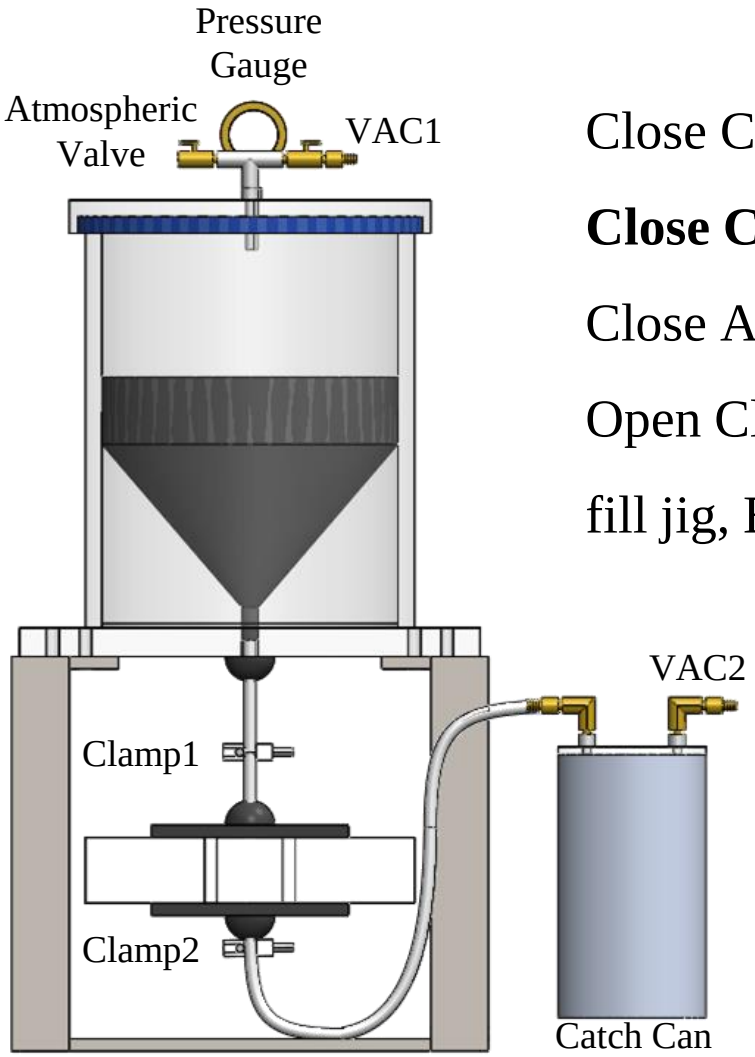

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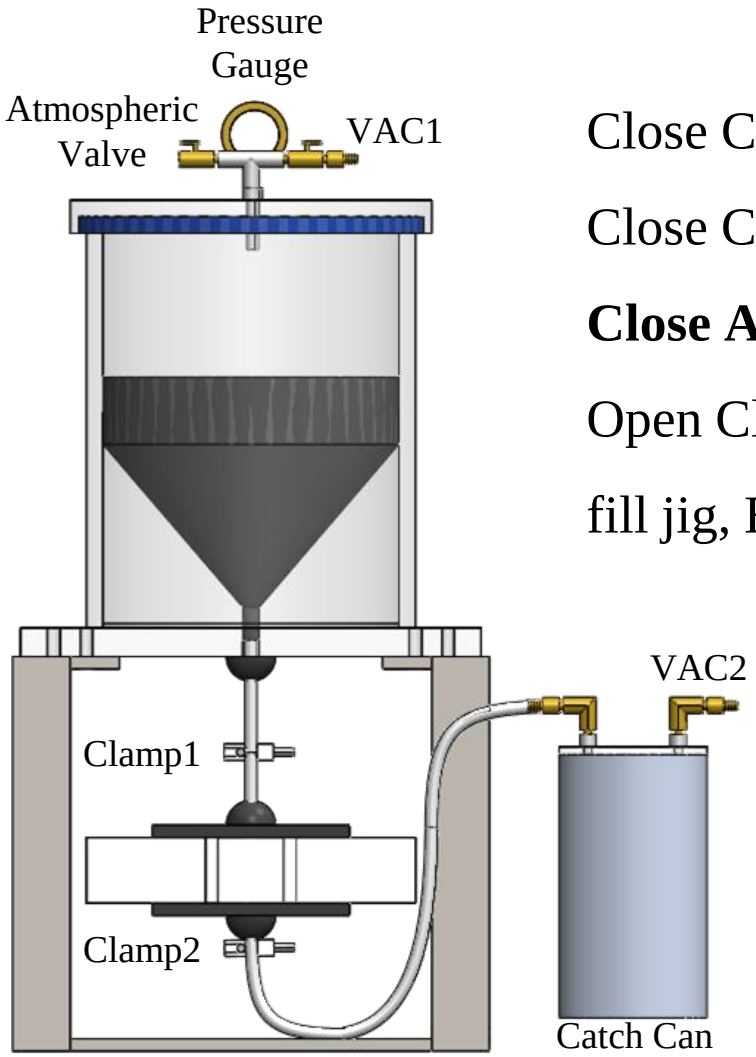

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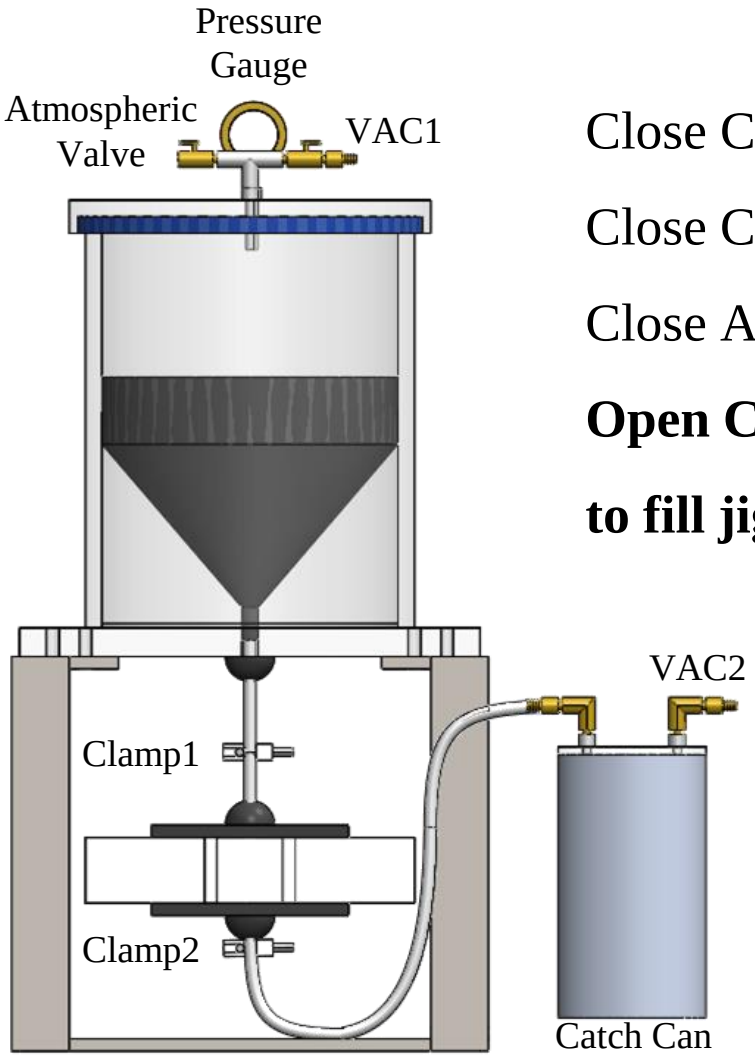

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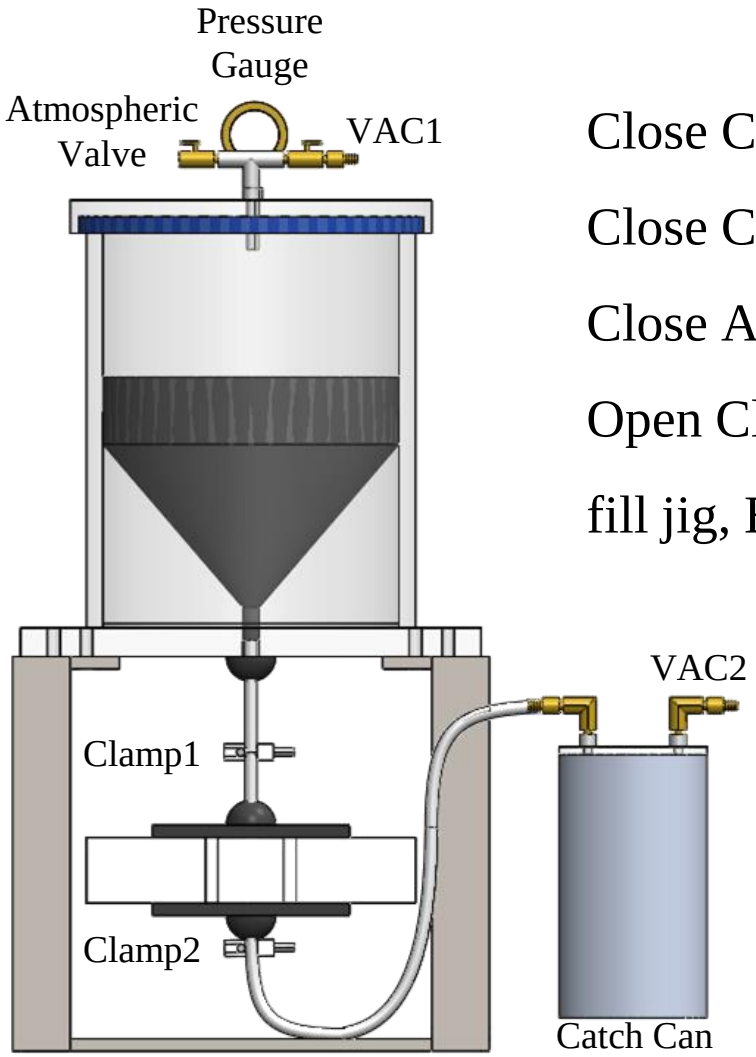

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6. Close Clamp1 and Clamp2, Detach jig, Allow silicone to cure.

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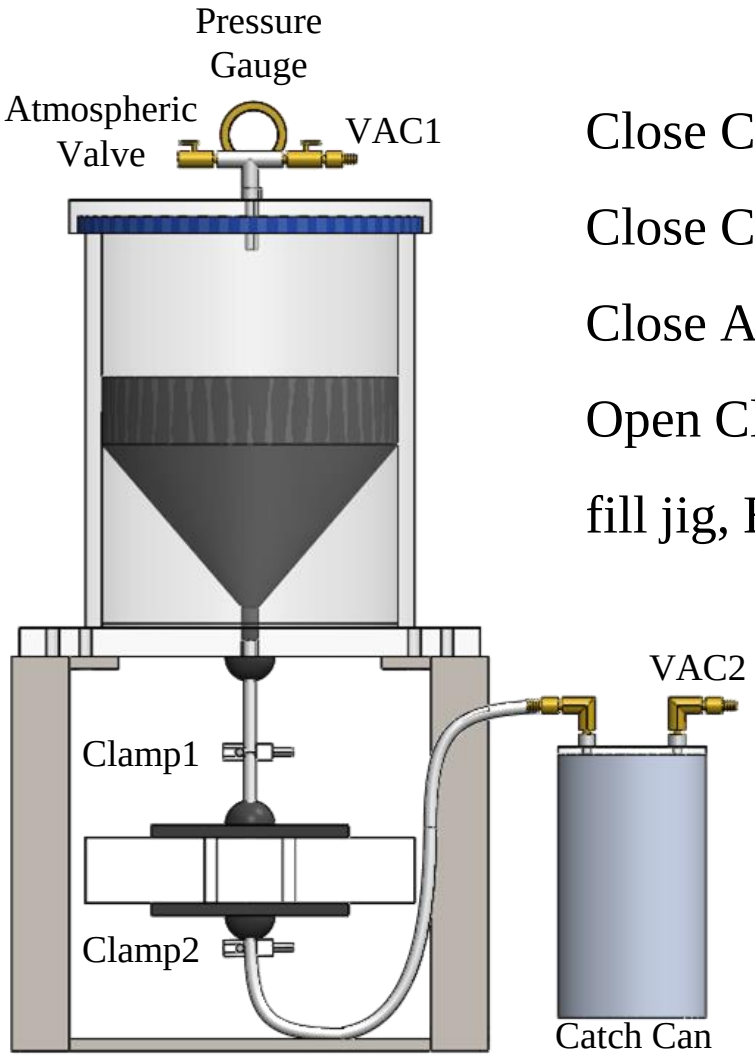

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Project Future

Catherine Kent

Project Future

- Receive build materials
- Have parts machined at the machine shop
- Build Prototype I
- Begin testing
- Make design adjustments for Prototype II, if necessary.

Summarization

Catherine Kent

Summary

- Design finalized and Bill of Materials created
- Met with stakeholders and advisers to help finalize design
  - Dr. Okoli
  - Dr. Hellstrom
- Placed all material orders
- Received PLA
  - Have begun printing practice lattices.

Works Cited

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Questions?