Air-Free Transfer Vessel For Sensitive Energy Storage Materials

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Objective and Research question

Our team's main goal is to manufacture and design an improved airtight vessel capable of transporting air-sensitive materials from a glovebox.

Background

- Many teams are interested in lithium battery cells[1]
- SEM is used to find material's morphology and composition
- Lithium is air sensitive
- Air-free vessel is needed [2]
- The vessel opens automatically inside tools like SEM

Method

1. Design in CAD SolidWorks
2. Manufacture at ASU Chandler Innovation Center using CNC milling and Lathe
3. Make an Improved prototype based on the design
4. Test the vessel for sealing capabilities in glovebox

Results

- Our team has remade the first design
- Our team's next step is to test for SEM
- After testing, the team will begin prototyping for a new design

How it Works

- Put the vessel into a vacuum chamber
- Evacuate all air in the chamber
- Once air leaves the vessel, fill the tube with argon
- The pressure of the argon will seal the vessel shut
- Inside the SEM machine, the pressure inside the SEM will surpass the Pressure in the vessel and will open the lid.

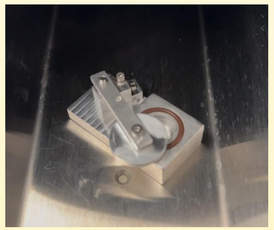


Figure 1: Vessel

Figure 2: evacuate all air

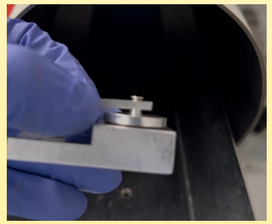


Figure 3: fully sealed vessel

Machines Used (ASU Chandler Innovation Center)

- Tormach CNC Mill – main base
- Mill – main base, Screw Mount
- Lathe – Cap, all screws
- Saw- all block components

First Design

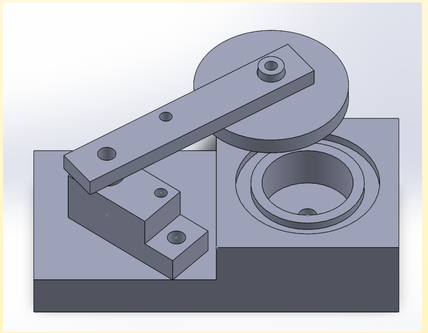
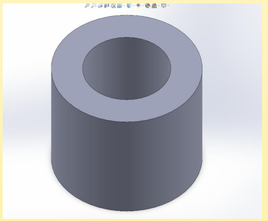


Figure 4: CAD

Figure 5: Physical model

Built with Cauê Nogueira

Possible New Design



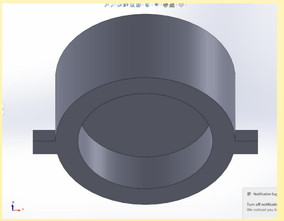


Figure 6: CAD of idea for new model

Possible Material Change

- 304 Stainless Steel

Figure 7: Picture of 304 Steel

References

[1] Janek, J., Zeier, W.G. Challenges in speeding up solid-state battery development. Nat Energy 8, 230–240 (2023). https://doi.org/10.1038/s41560-023-01208-9t
[2] J. Schneider, D. Agocs, and A. Prieto, Design of a Sample Transfer Holder to Enable Air-Free X-ray Photoelectron Spectroscopy, ACS Publications, Aug. 24, 2020. https://pubs.acs.org/doi/full/10.1021/acs.chemmater.0c01895

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