Reusable RF Electrodes

Design Review 5
Team 314
Abbott Laboratories
03/25/22

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FAMU-FSU Engineering

Team Members

Brooke Bielski

(BME)

Financial Advisor

Adam Chebali

(CpE)

Computer Engineer

Carolina Hau Loo

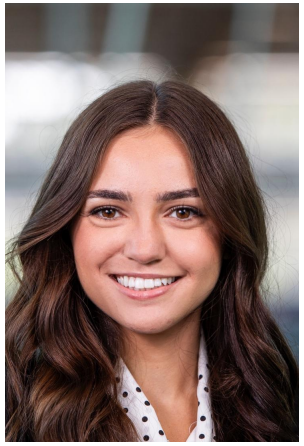
(EE & CpE)

Design and Testing Engineer

Tariq Hopkins

(EE)

Lead Electrical Engineer



Shannon Kelley

(BME)

Lead Biomedical Engineer

Joshua Mechler

(EE)

Project Manager

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Sponsor & Advisor

- Sponsor: Abbott Laboratories
- Medical Device Company
- Contact: Bryan Burnett

- Advisor: Dr. Rajendra Arora
- Professor: ECE Department
- Specialty: RF and Electromagnetic Fields

Outline

Figure 1. Product Development [1]

Brief Overview

RF Ablation:

- Radiofrequency ablation is a common procedure for relieving pain.
- It greatly benefits people suffering from chronic pain.

How it works:

- Electric current heats up nerve tissue and stops it from sending pain signals.

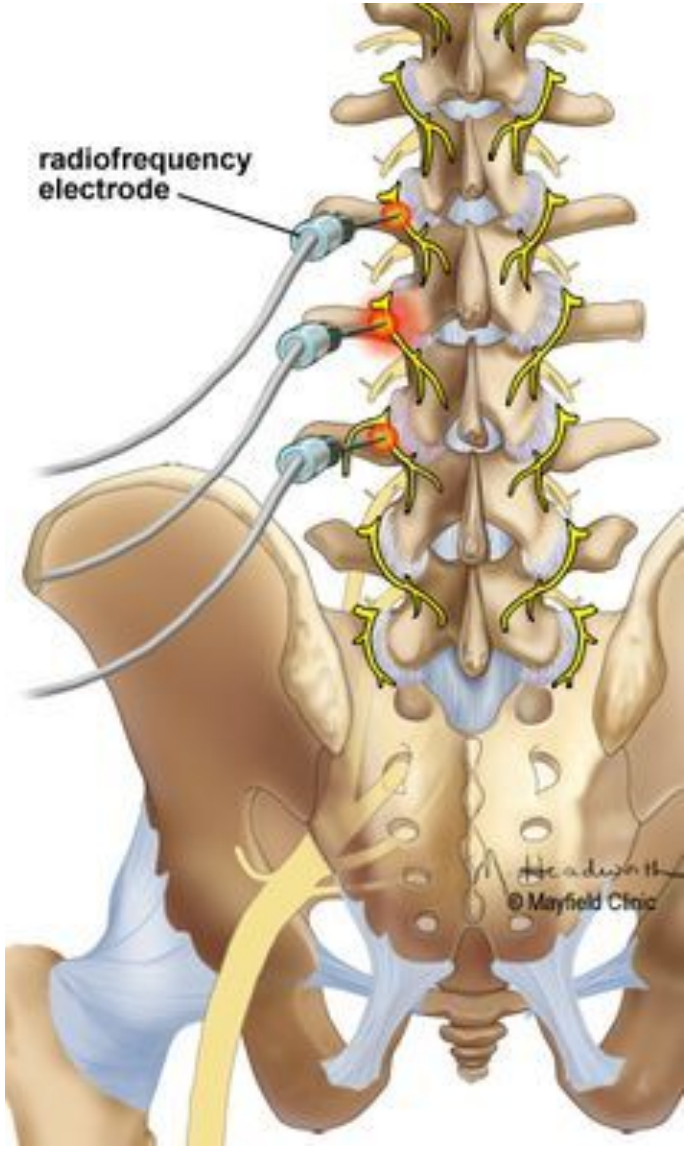

Figure 2. RF Ablation Therapy [2]

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Problem Statement

Project Scope:

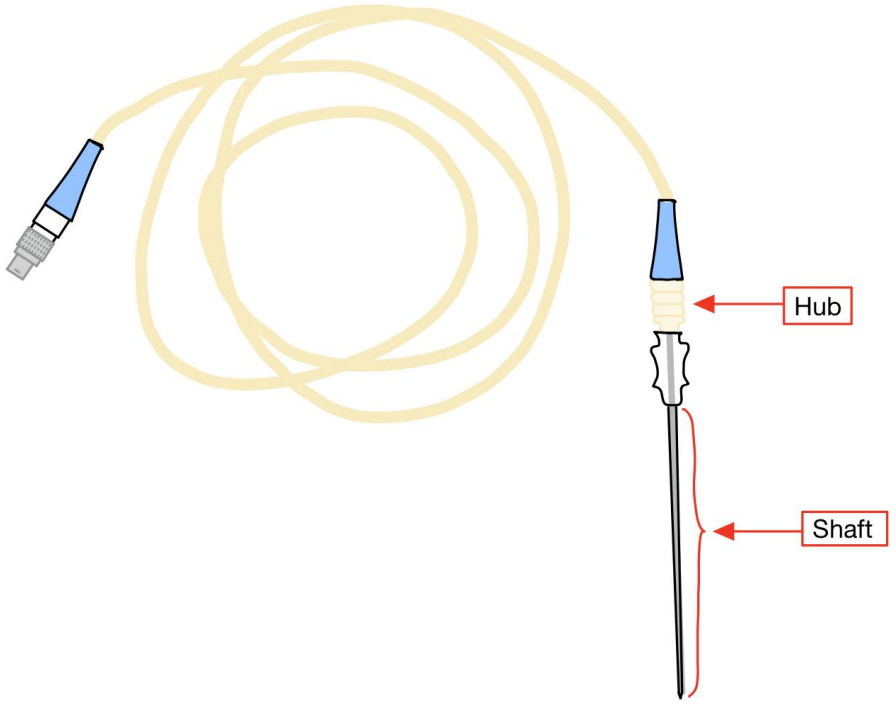
- Improve Reusability

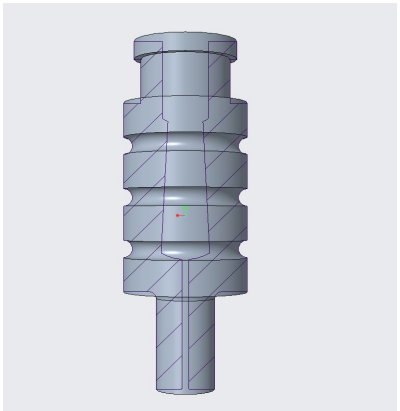
Customer Needs:

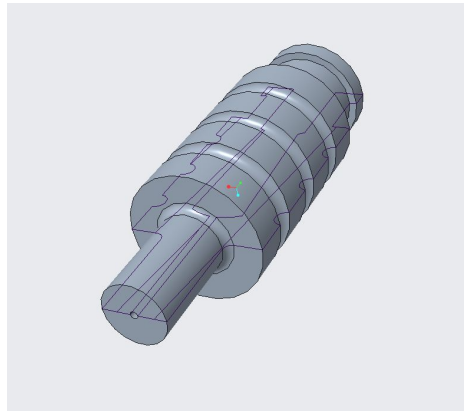
1. Biocompatible Materials
2. Withstand at least 100 uses
3. Propagate RF signals (2 Hz - 460 kHz)
4. Measures temperature
5. Repeated sterilization
6. Repeated procedure stress
7. Production cost less than $200
8. Pass FDA approval

Final Concept

- 304 Stainless Steel shaft
  - + Biocompatible
  - + Cost effective
  - + RF propagation
- PPSU (Polyphenylsulfone) Hub material
  - + Virtually unlimited steam sterilization (>1000)
  - + Better chemical resistance than PET
  - + Biocompatible
  - + Already in use in the medical field
  - – Higher Cost







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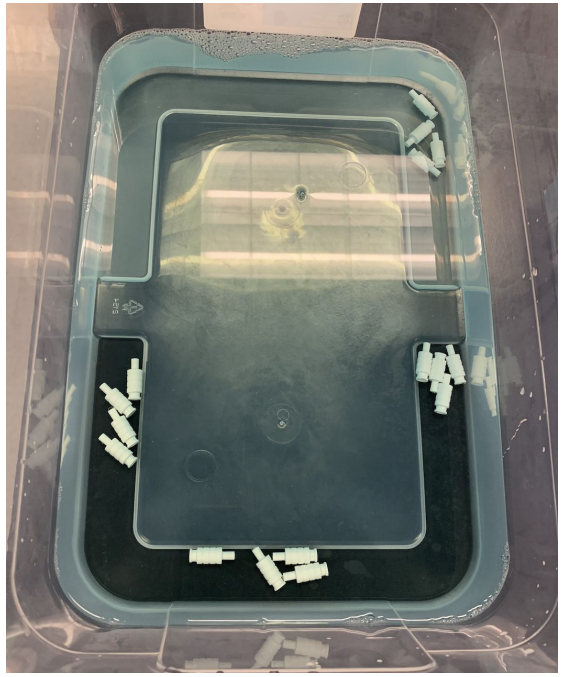
Current Work

- Completed Chemical Enzyme (Medline Dual Enzymatic Detergent) and Autoclave cycling

- Mechanical Stress Testing



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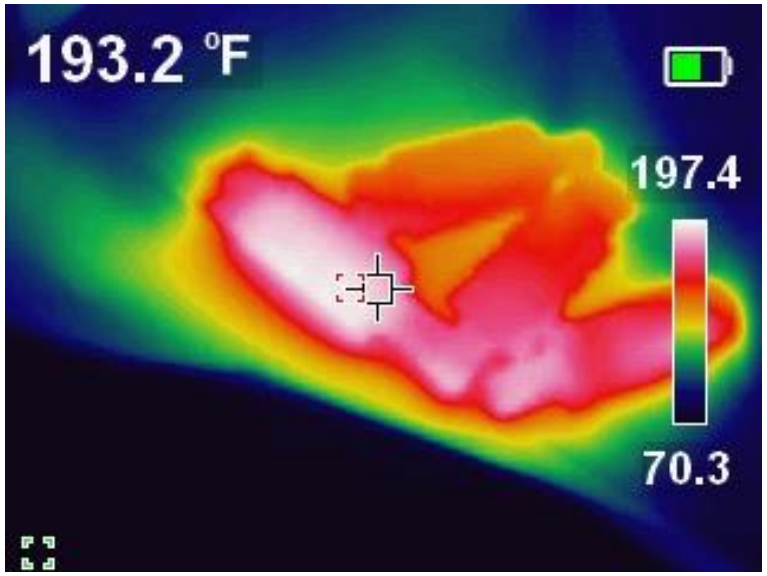
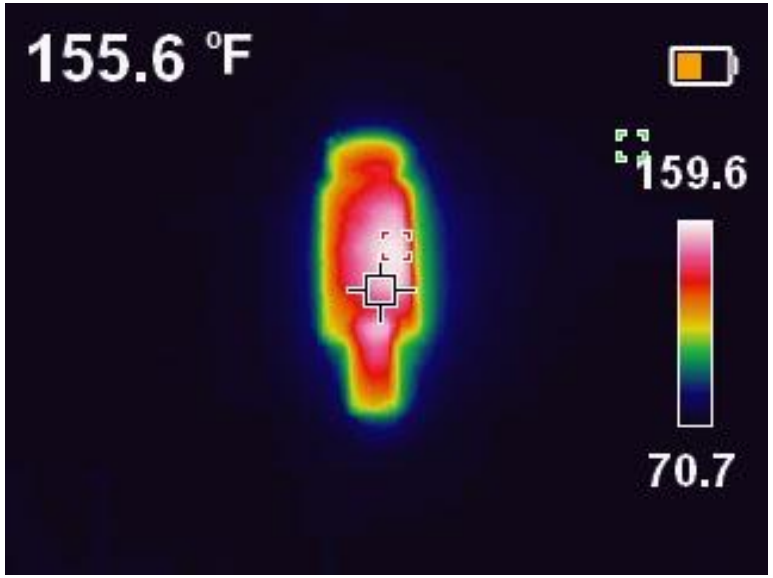
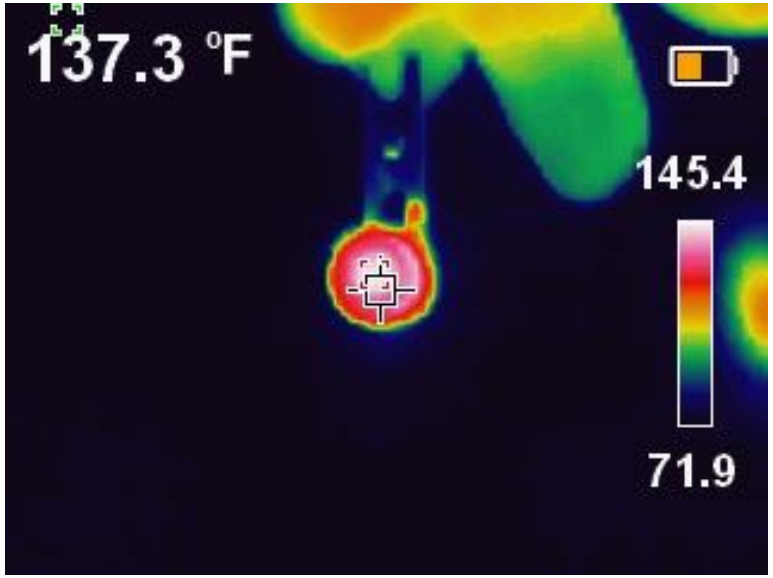
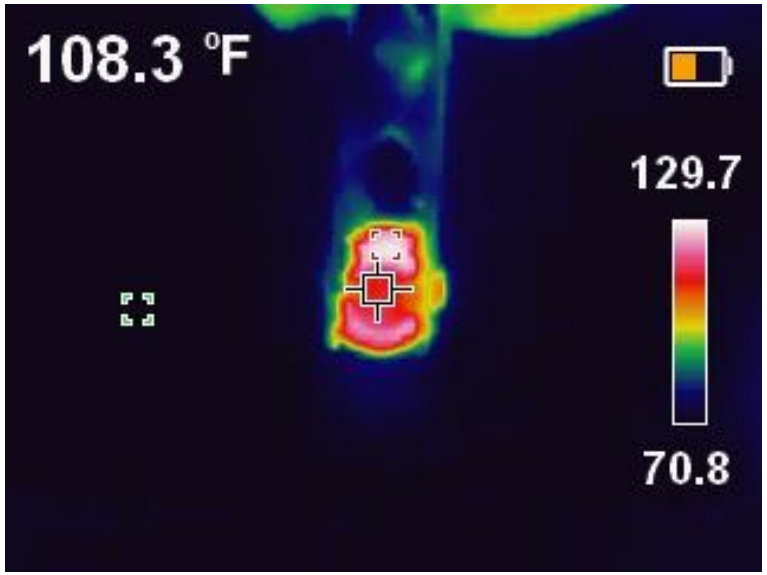
Current Work

- Thermal Camera (Klein Tools TI250)
- Areas of higher temperature in the hub
- Hypothesize that epoxy holds heat longer









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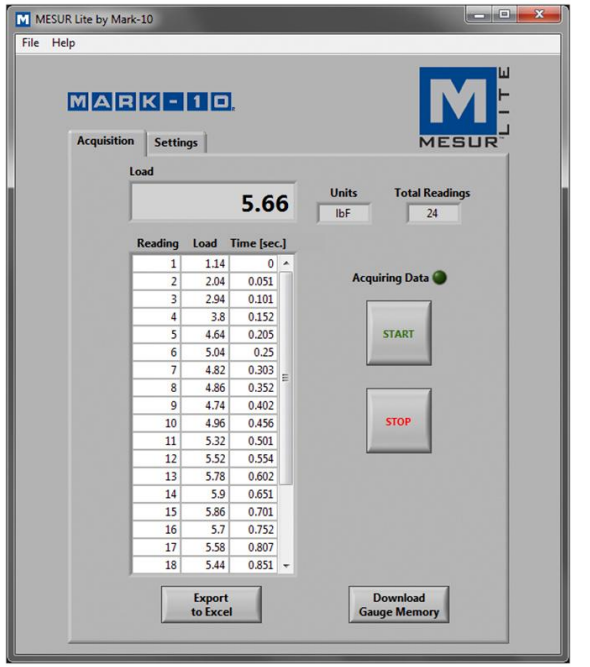
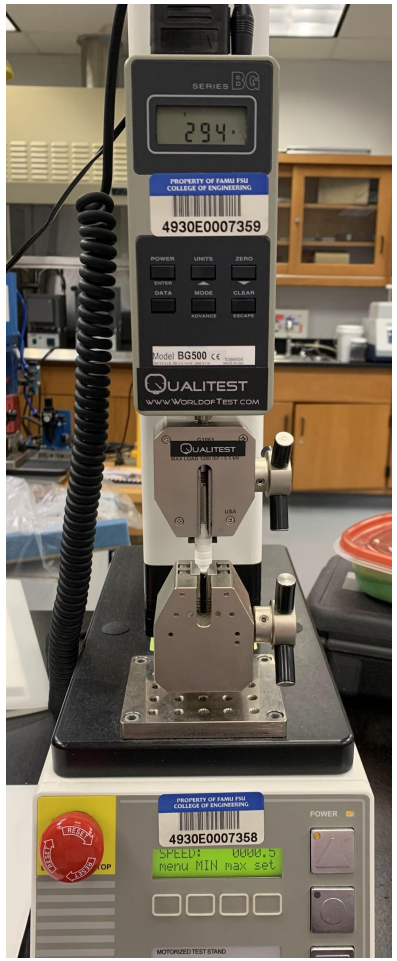
Stress Testing

- Autoclave Sterilization
  - Chemical Enzyme (30 mins)
  - Sterilization cycle at 132℃ (4 ~ mins)
  - 5 - 15 cycles

- Mechanical Stress Testing
  - Force Test Stand (MARK-10 model ESM301)
  - Software: MESUR® Lite by MARK-10





Presenter: Joshua Mechler

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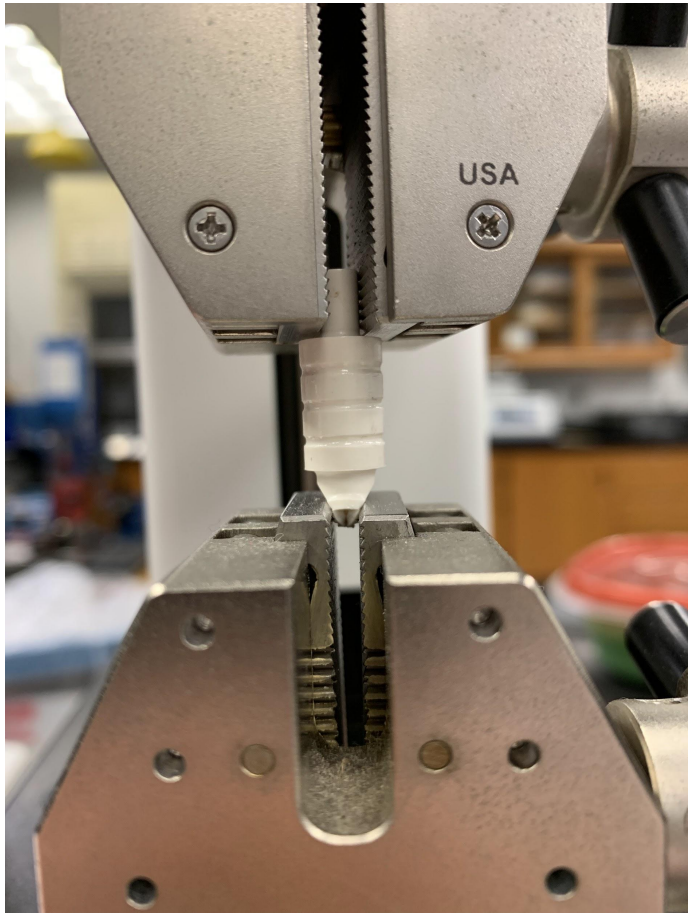
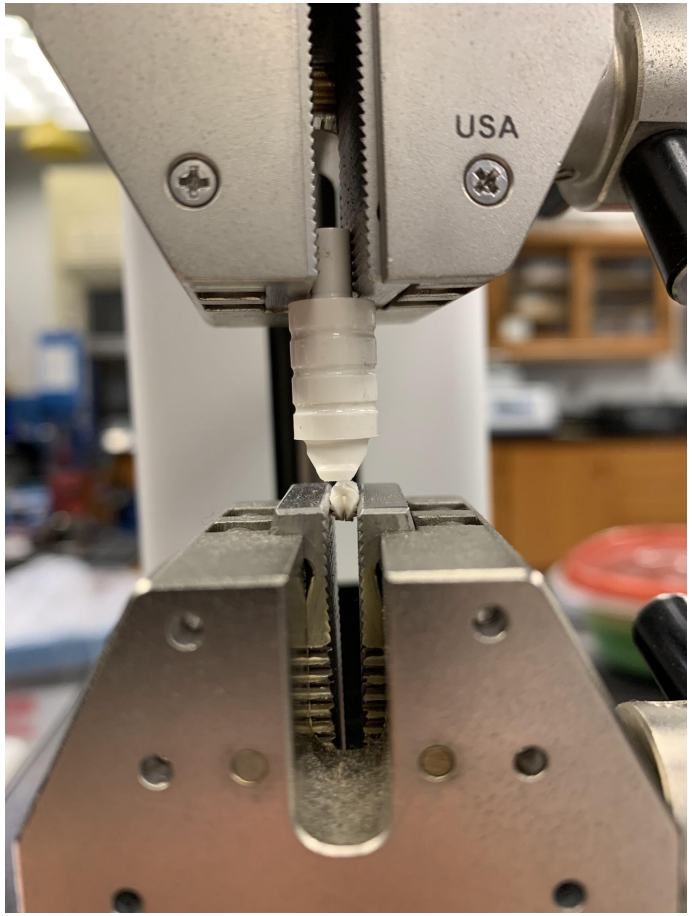
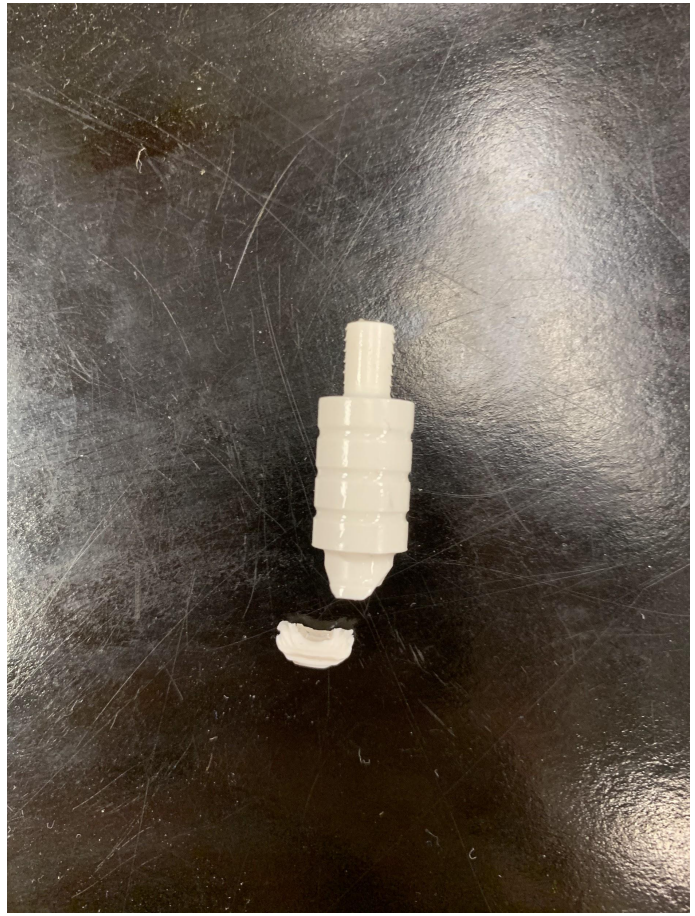
Mechanical Stress Testing







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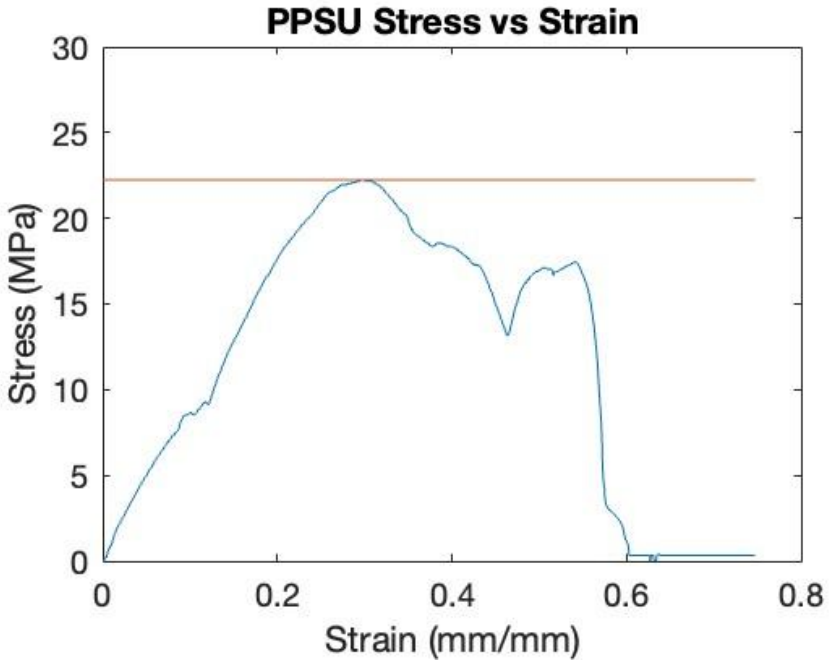
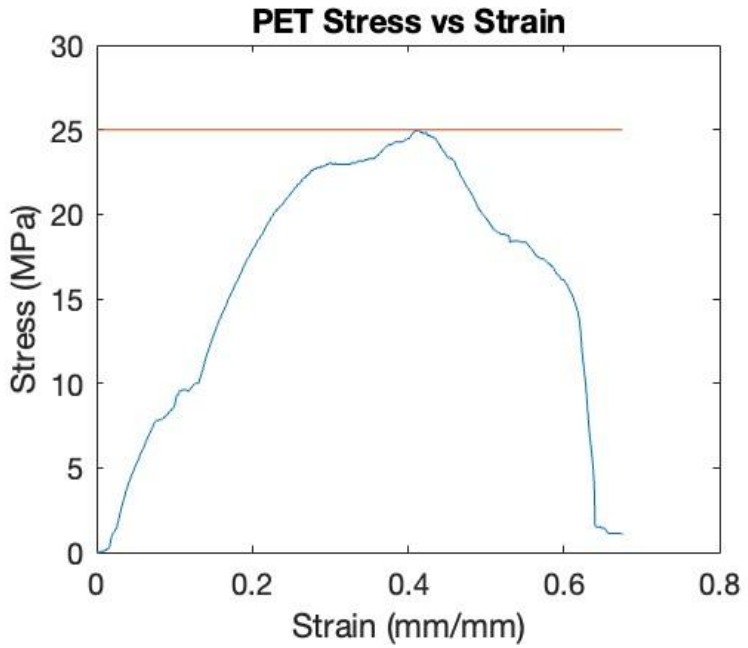
Mechanical Stress Data

- Cross-sectional area taken at thinnest diameter of the device (for stress calculation)
- Strain rate 2 mm/min





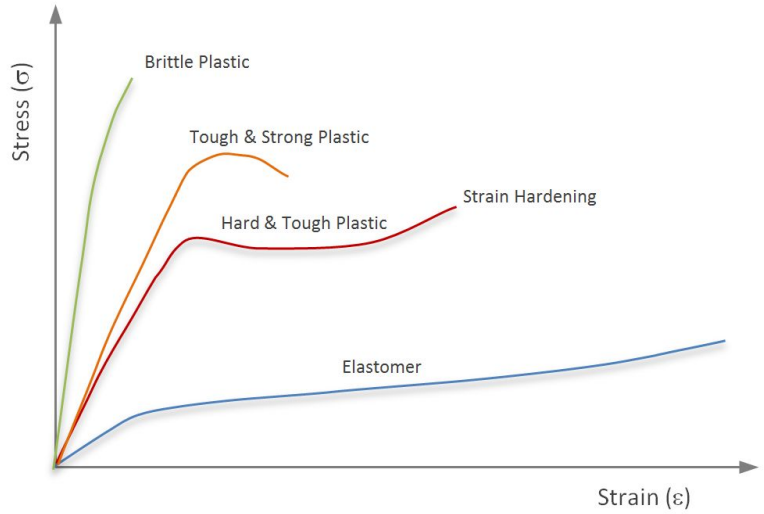


Figure 3. Stress-strain Behavior of Polymers [3]

Presenter: Carolina Hau Loo

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Future Work

- Continue *modified* mechanical stress testing
- Perform final data analysis
- Prepare for Design Day

Figure 4. Business Handshake Collaboration [4]

Summary

- Sponsor: Abbott Laboratories
- Product: Reusable RF Electrode
- Use: RF ablation for chronic pain
- Prototyping
- Quality Assurance Tests
- Future Plans

Acknowledgements

- Dr. Rajendra Arora (Project Advisor)
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- Dr. Hooker (ECE Professor)
- Hebert Lopez (ECE SD TA)
- Emily Hubicki (BME Lab Manager)

Figure 5. Problem solving techniques [5]

References

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Questions?

Figure 6. Customer Insight [6]

Mechanical Stress Data (extra)

- Raw data from MESUR® Lite given in Load (N) and Time (sec)
- Strain rate is 2 mm/min

Strain = (2[mm/min] * Time[sec]/60) / (total length [mm])

Stress = Force[N] * area[mm^2]

For area, we took the smallest diameter (4[mm]) of the prototype as our cross-sectional area diameter.

Broken Hubs