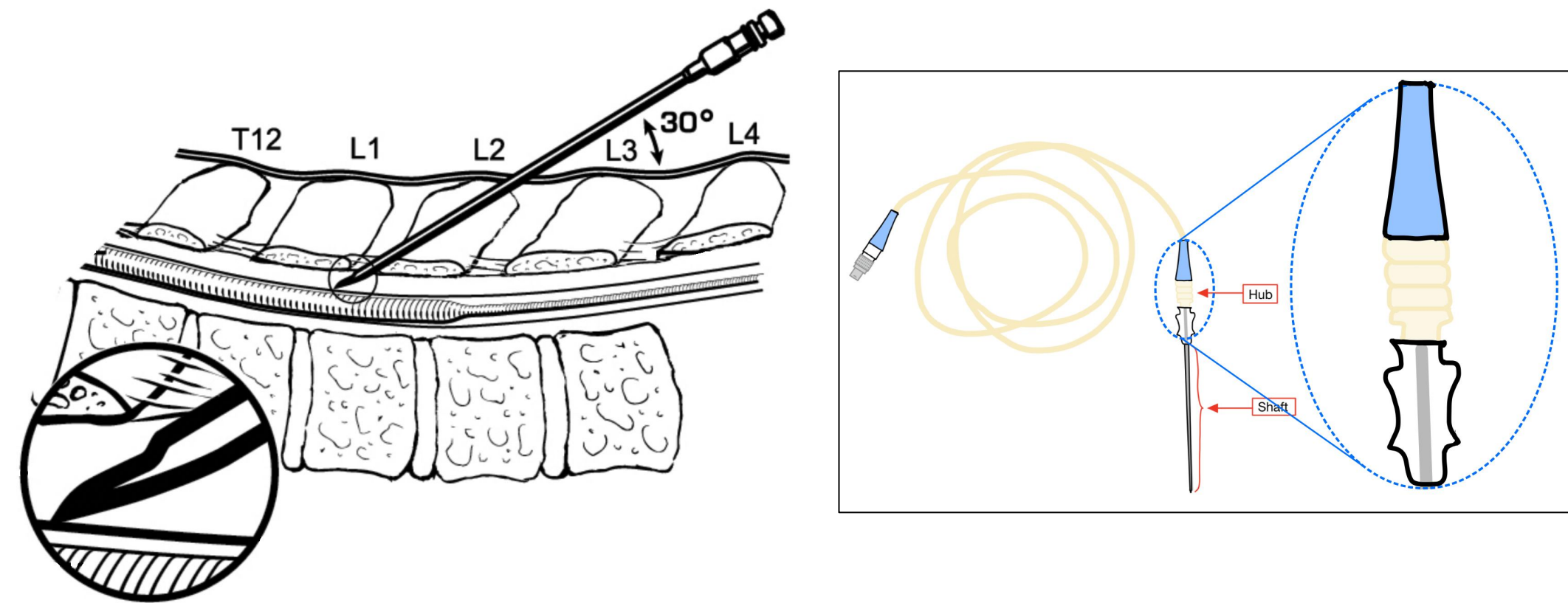


Introduction

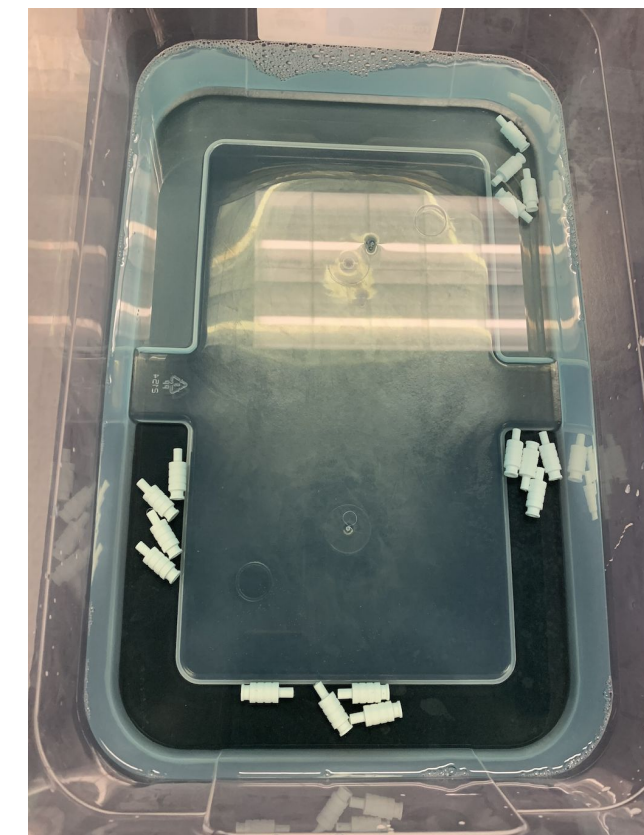
Radiofrequency (RF) ablation is a common therapy used for alleviating chronic pain. Abbott's current reusable RF electrode can withstand about 50 uses before degradation of materials.

Objective: Increase the reusability of the electrode to upwards of 100 uses while also maintaining an affordable unit cost of roughly \$200.



Experimental Methods

Enzyme Cleaner



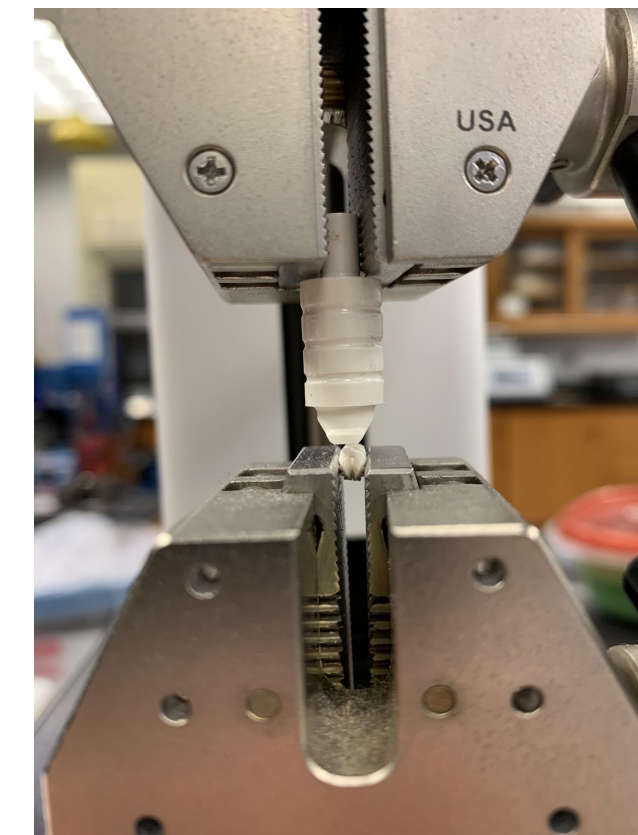
- Medline Enzymatic Cleaner
- 30 mL enzyme cleaner to 3800 mL water (~40-50°C)
- 30 minute soak

Sterilization



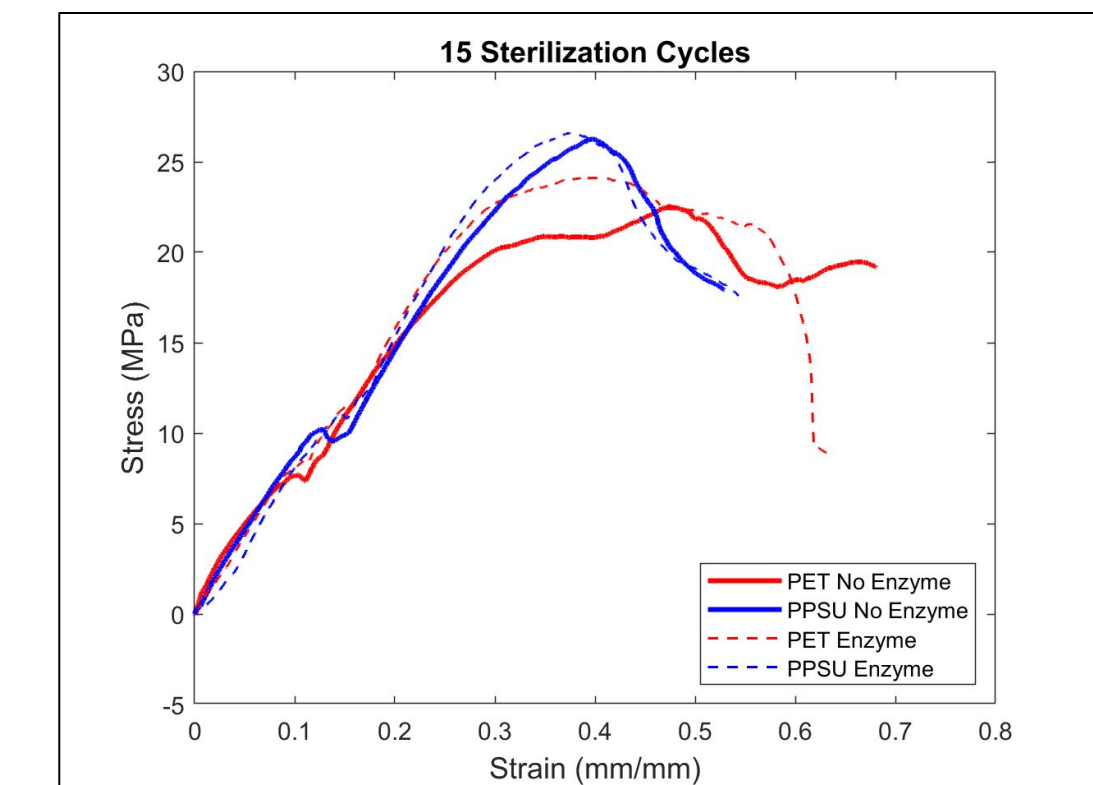
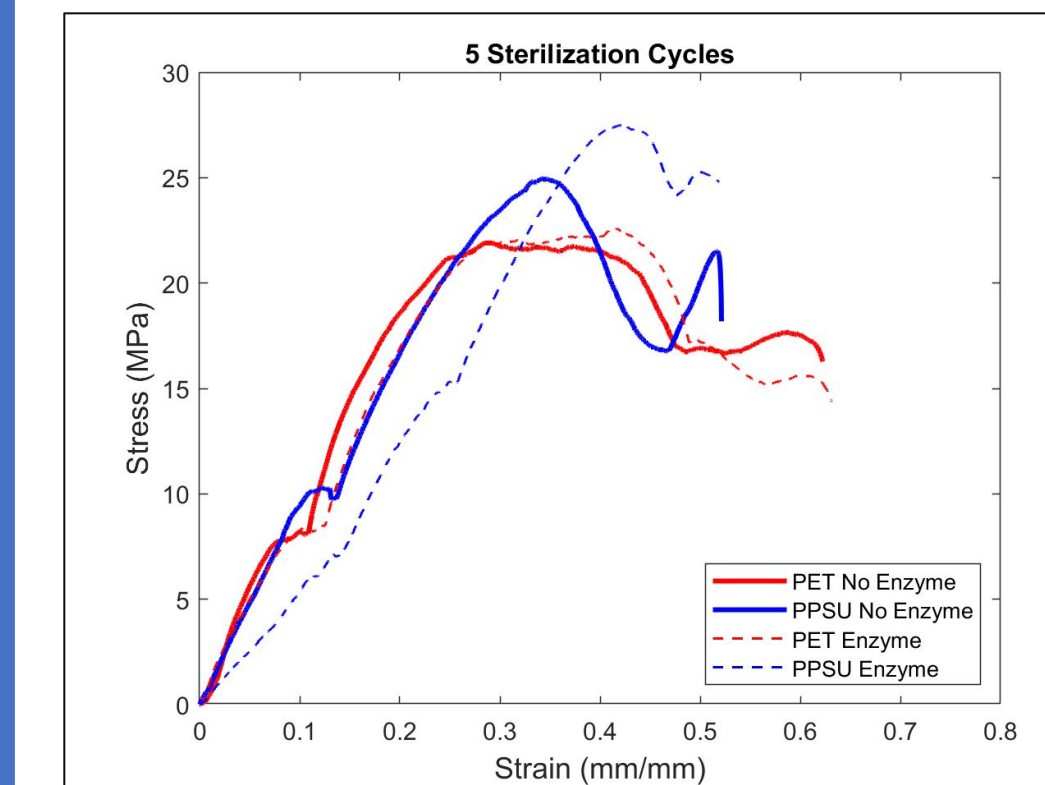
- 5 cycles and 15 cycles
- Four minutes at 132° C
- 1 ½ hours to complete the full cycle

Tensile-Stress Tests



- Force Test Stand (MARK-10 model ESM301)
- Unable to properly grip hubs

Results and Discussion



- Ultimate strength for PPSU is higher than that of PET in all cases.
- Based on the 5 and 15 sterilization cycle graphs, the enzyme cleaning process increased the ultimate strength of both materials.
- PPSU projected to last longer than PET.
- Heat concentrated in the epoxy used to fill the hubs.

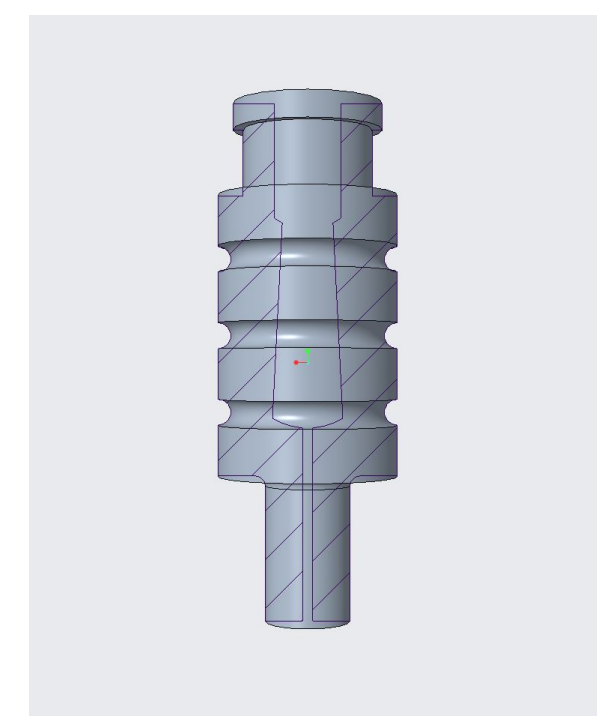
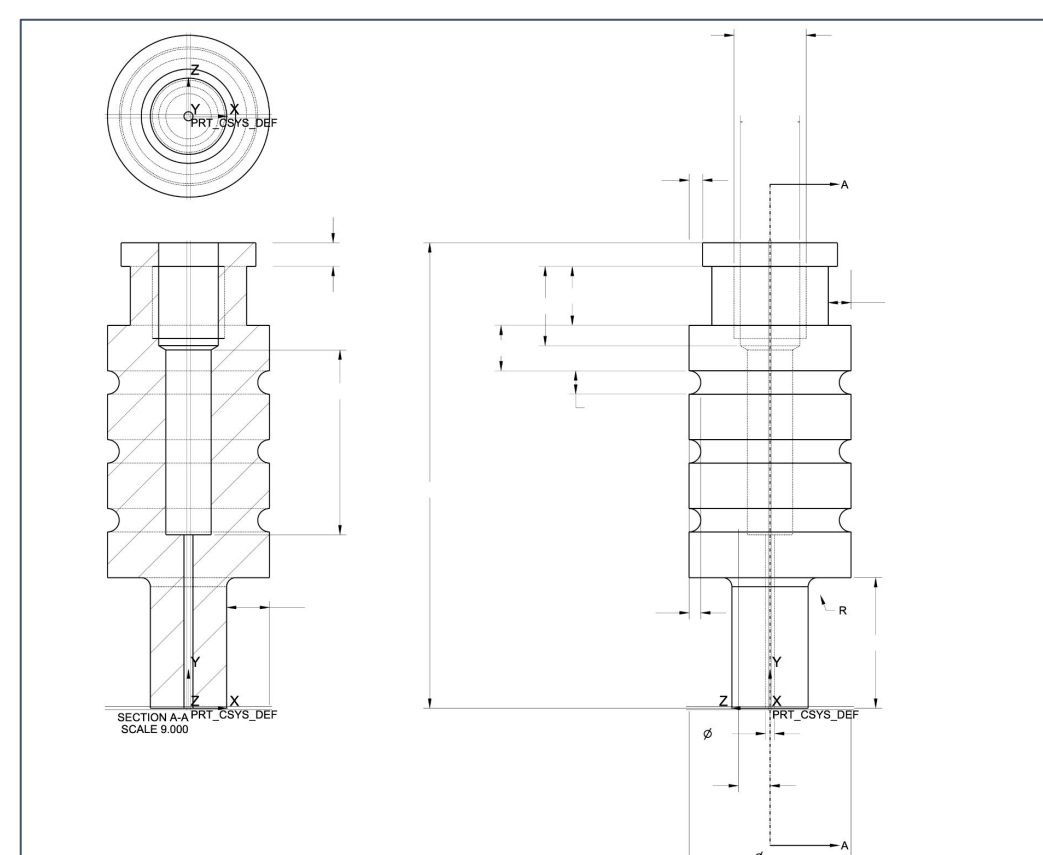
Final Concept

The Hub - PPSU (Polyphenylsulfone)

- Made by Radel, PPSU is a super-tough, high-heat polymer that has been used in the healthcare industry for over 30 years. [1]
- Passes ISO 10993 Biocompatibility testing.
- Capable of withstanding virtually unlimited steam sterilization.
- Excellent resistance to commonly used hospital disinfectants.

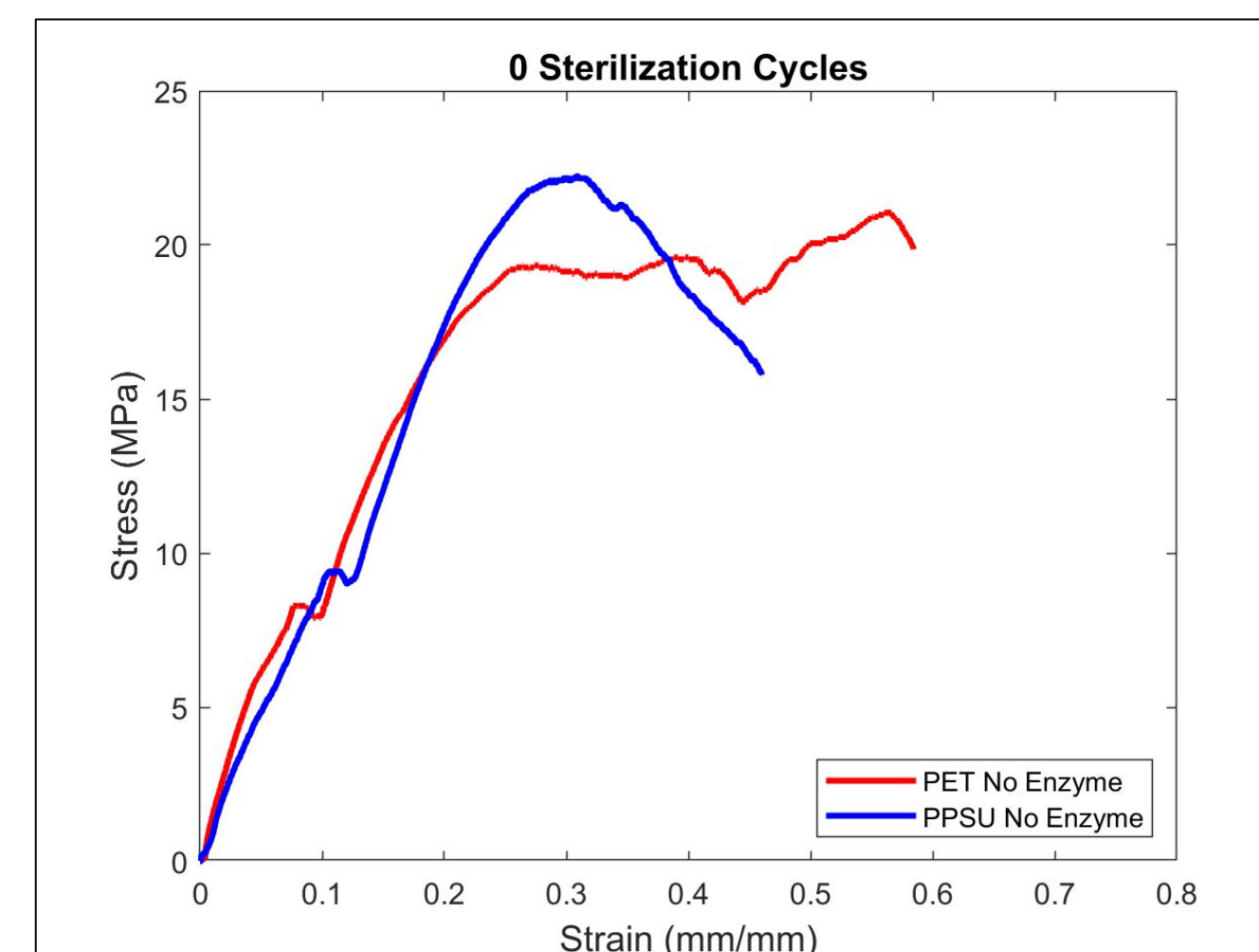
The Shaft - 304 Stainless Steel

- The most cost-effective solution that fulfills our customer's needs.
- Will be used to house the thermocouple, which will read the temperature at the tip of the shaft.
- Will transmit the RF energy to the nerve tissue at the treatment site.

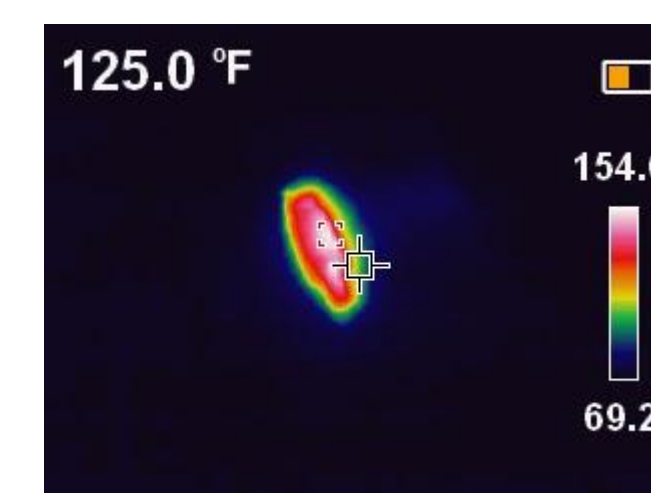


Results and Discussion

Tensile-Stress Tests

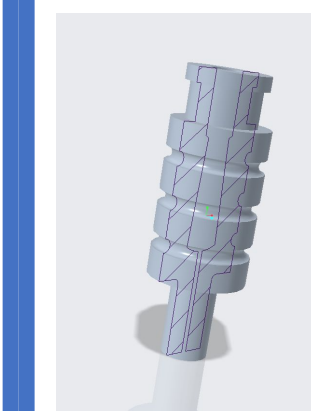


Thermal Camera



- Mechanically tested hubs at zero sterilization cycles and zero enzymatic cleanings.
- Used thermal camera to observe heat concentration after sterilization cycle.

Conclusion



- Hypothesis of PPSU being a suitable replacement for PET proved to be true.
- Tensile stress graphs proved as more autoclave cycles were administered, PPSU performed better than PET.
- The enzyme cleaning process appeared to have little to no effect on the structural performance of the hub.

References

[1] "Radel® PPSU," Solvay. [Online]. Available: <https://www.solvay.com/en/brands/radel-ppsu>. [Accessed: 18-Nov-2021].

Acknowledgements

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