

IMPROVED ULTIMATE TENSILE TESTER (Experimental Results)

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Activity Report

1 RESEARCH QUESTION

The primary goal of our improved uniaxial tensiometer system is to increase system accuracy by finding ways to calibrate our sensors and make the overall interaction with the system very easy to use. To demonstrate the accuracy of our system, we tested our system on two different types of material (latex and nitrile) and compared the values of Young's modulus and ultimate tensile strength computed from the stress-strain curve to known values for these materials.

2 EXPERIMENTAL RESULTS

Show the following results of your system.

- 1) Stress-strain curve for latex glove (See Figure 1).
- 2) Stress-strain curve for nitrile glove (See Figure 2).
- 3) Table summarizing key metrics (Young's Modulus and Ultimate Tensile Strength) derived from stress-strain curves compared to known values from the original research paper (See Table 1).

From the graphs, we are able to determine the Young's Modulus value by calculating the slope of the elastic region. In addition, we can

also find the Ultimate Tensile Strength value by grabbing the highest value in the plastic region. From this, our system's Young's Modulus value for the Latex Glove was 743 kPa and Nitrile Glove was 2 MPa . Our Ultimate Tensile Strength for the Latex Glove was 3.4 MPa and Nitrile Glove was 4.6 MPa. Due to this, our percent errors were relatively low meaning our values are fairly accurate and precise.

3 DATA ANALYSIS

Our system is accurate in terms of finding Ultimate Tensile Strength and Young's Modulus as our percent errors were low and our values were within the same region of magnitude compared to the real values. All of our parts in our design were effective as anticipated. Lessons learned on building a tensiometer is that you should always make sure your sensors are properly calibrated before running tests. In addition, having good clamps and a good pulley technique makes the process of stretching the material much easier.

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| Metric | Sample | # Trials | Our System | Known Value | Error |
|---------------------------|---------------|----------|------------|---------------|-------|
| Young's Modulus | Latex Glove | 2 | 743 kPa | 740 ± 10 kPa | 0.406 |
| .. | Nitrile Glove | 4 | 2 MPa | 2.4 ± 0.2 MPa | -16.7 |
| Ultimate Tensile Strength | Latex Glove | 2 | 3.4 MPa | 3.3 ± 0.1 MPa | 3 |
| .. | Nitrile Glove | 4 | 4.6 MPa | 4.4 ± 0.1 MPa | 4.5 |

Table 1
Summary of experimental results from multiple trials

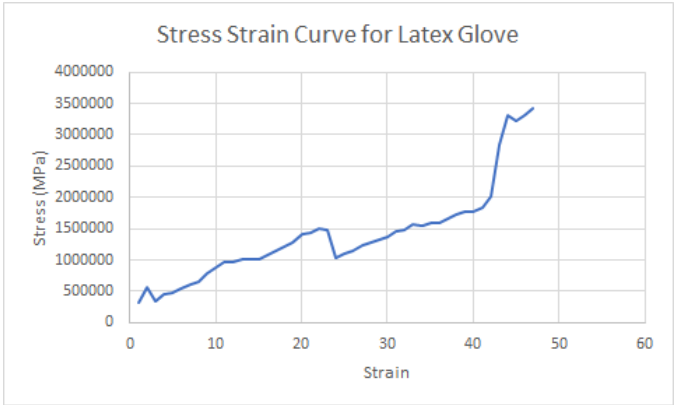


Figure 1. Stress-strain curve derived from our system for Latex glove sample

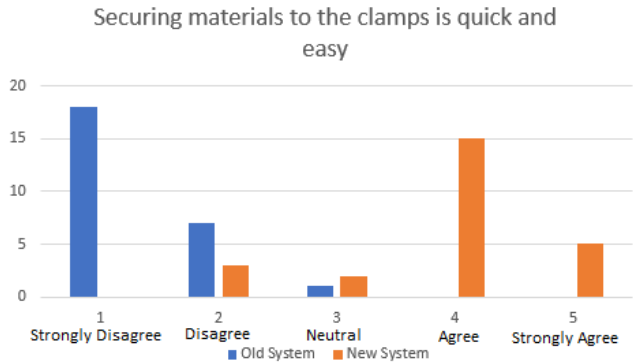


Figure 3. Ease of Use Data comparing old to new system when using clamps

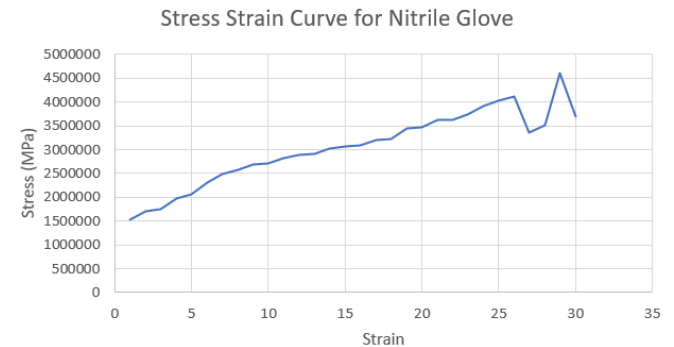


Figure 2. Stress-strain curve derived from our system for nitrile glove sample