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Engineering 101 C

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Tensile Lab Report

Methods:

To find the Yield Strength, I made a trend line through the linear portion of the graph, offset the x values by .002 and approximated the intersection of the trend line and the scatter plot. The value at the intersection of the Stress represented a rough value for Young’s Modulus.

To find the Young’s Modulus, I took the slope of the trendline by calculating the change in stress divided by the change in strain.

To find the Tensile Strength, I simply found the maximum value of the stress values.

To find the ductility, I divided the final displacement measured by the machine by the initial test length and converted the division into a percentage.

To find the toughness and the resilience, I used the trapezoidal rule and created a column of area slices. The toughness was the sum of all area slices up until the point of fracture, whereas the resilience was only the sum of the area slices between the start and the end of the elastic deformation region.

The following pages contain the graphs and tables for the material properties of four metals: Steel, Annealed Steal, Aluminum T4, and Aluminum T6.

Aluminum T6

Figure 1 Aluminum T6 Stress Vs. Strain Scatter Plot with a trend line for the linear portion of the elastic region.

Aluminum T4

Figure 2 Aluminum T6 Stress Vs. Strain Scatter Plot with a trend line for the linear portion of the elastic region.

|  |  |
| --- | --- |
| Young's Modulus (E) | 554126.58 |
| Yield Strength (psi) | 6100.00 |
| Tensile Strength (psi) | 15033.18 |
| Ductility (% Elongation) | 29% |
| Toughness (Joules) | 3765.68 |
| Resilience (Joules) | 829.64 |

Table 2 Aluminum T4 Material Properties

Steel (Annealed)

Figure 3 Steel (Annealed) Stress Vs. Strain Scatter Plot with a trend line for the linear portion of the elastic region.

|  |  |
| --- | --- |
| Young's Modulus € | 2229951.20 |
| Yield Strength | 42901.00 |
| Tensile Strength | 61455.06 |
| Ductility % | 45% |
| Toughness | 18597.27 |
| Resilience | 370.42 |

Table 3 Steal (Annealed) Material Properties

Steel

Figure 4 Steel Stress Vs. Strain Scatter Plot with a trend line for the linear portion of the elastic region.

|  |  |
| --- | --- |
| Young's Modulus € | 3385527.30 |
| Yield Strength | 143000.00 |
| Tensile Strength | 145279.67 |
| Ductility | 10% |
| Toughness | 5528.19 |
| Resilience | 3373.73 |

Table 4 Steel Material Properties