MATERIALS LAB WEEK 1

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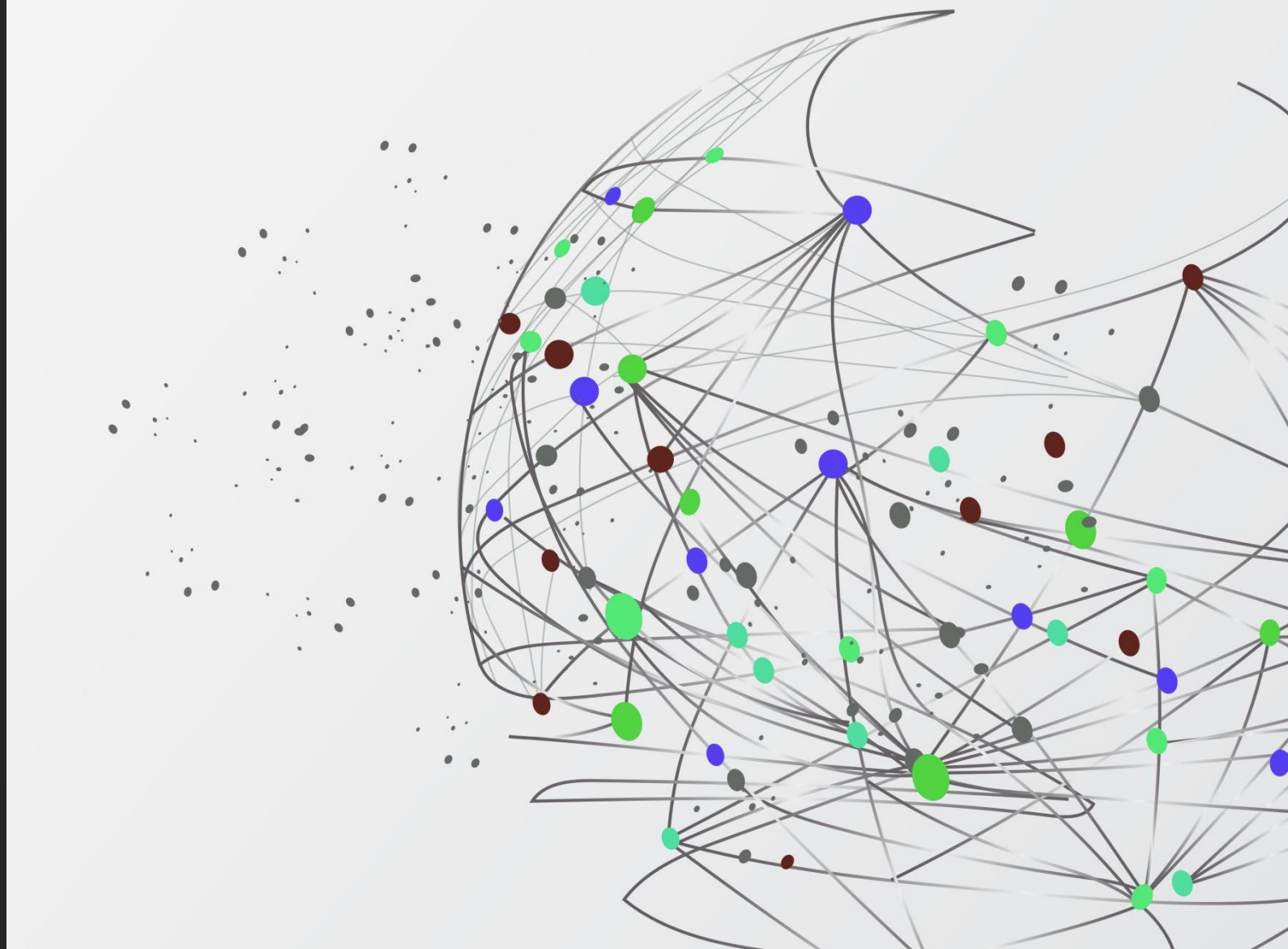


COMPARISON OF LAB MANUAL AND ASMT E6M

- • **Subject Measurement**: Both the lab and ASTM E8M require measuring dimensional accuracy before testing
- • **Machine Calibration & Load**: ASTM E8M specifies calibrated machines with controlled load application; the lab uses an MTS machine, which aligns with this requirement.
- • **Stress-Strain Curve**: Both methods involve generating and analyzing stress-strain curves to find key properties like Young's modulus and yield strength.
- • **Young's Modulus**: In both methods, it is calculated from the slope of the stress-strain curve in the elastic region.
- • **Yield Strength**: I used a plot observation to find yield strength, which differs from the ASTM recommendation of the 0.2% offset method.

MDF

Sample	Young's Modulus (MPa)	Toughness (MPa)	Yield (MPa)	Ultimate (MPa)	Fracture (MPa)
1	2116.21060	0.18596400	14.91	19.4154250	21.6716027
2	2156.62789	0.17771875	15.82	19.2556929	21.3834022
3	2175.87151	0.19794311	16.29	20.2103856	22.5284536
4	2190.99179	0.24837222	15.99	20.6500078	22.3795753
5	2386.06444	0.32355389	18.16	23.6511607	15.3094506
6	2238.46334	0.19236636	16.41	20.7213301	23.1164892
7	2260.87327	0.24486564	16.49	21.6022672	24.0901242
8	2202.80879	0.22123448	16.61	20.8961855	23.2402933
9	2275.07066	0.26317420	16.50	22.4291239	24.9903601
10	2144.19175	0.18379123	14.74	19.7223445	21.4429025

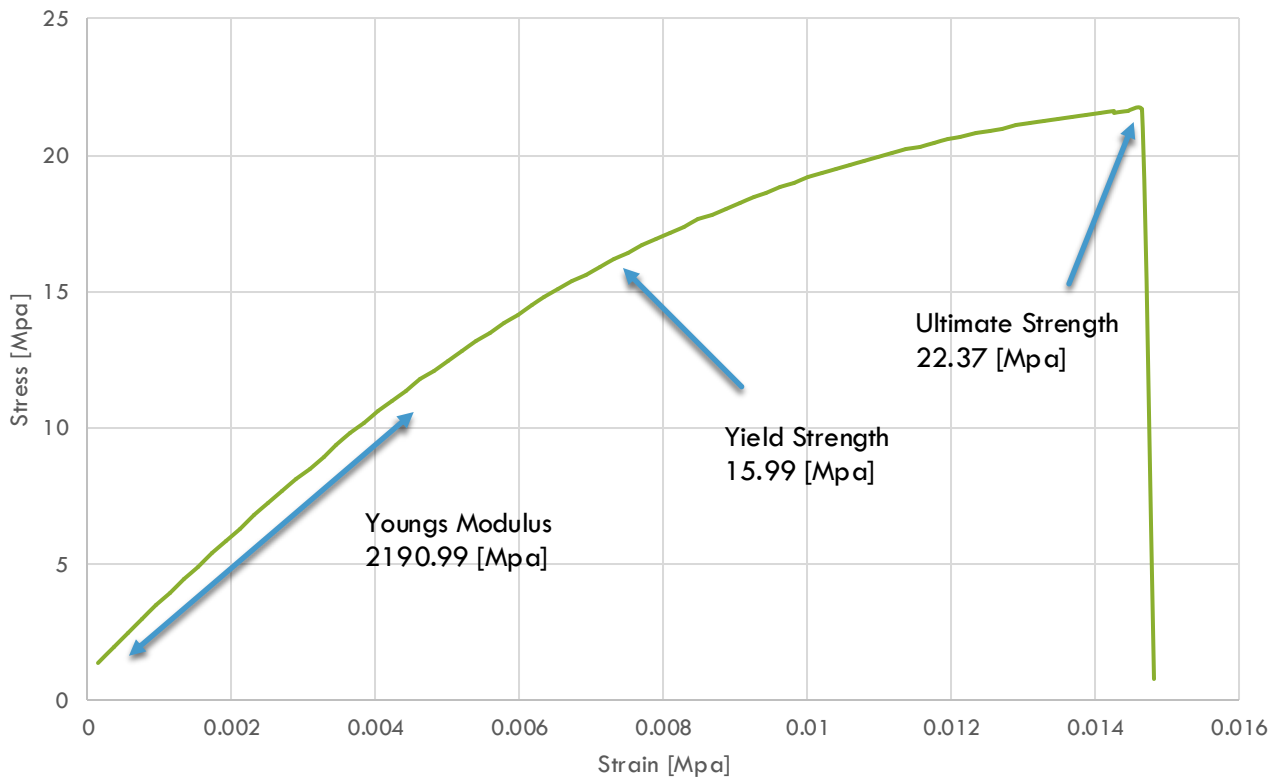


Figure 1: Sample 4 MDF

AL 3003

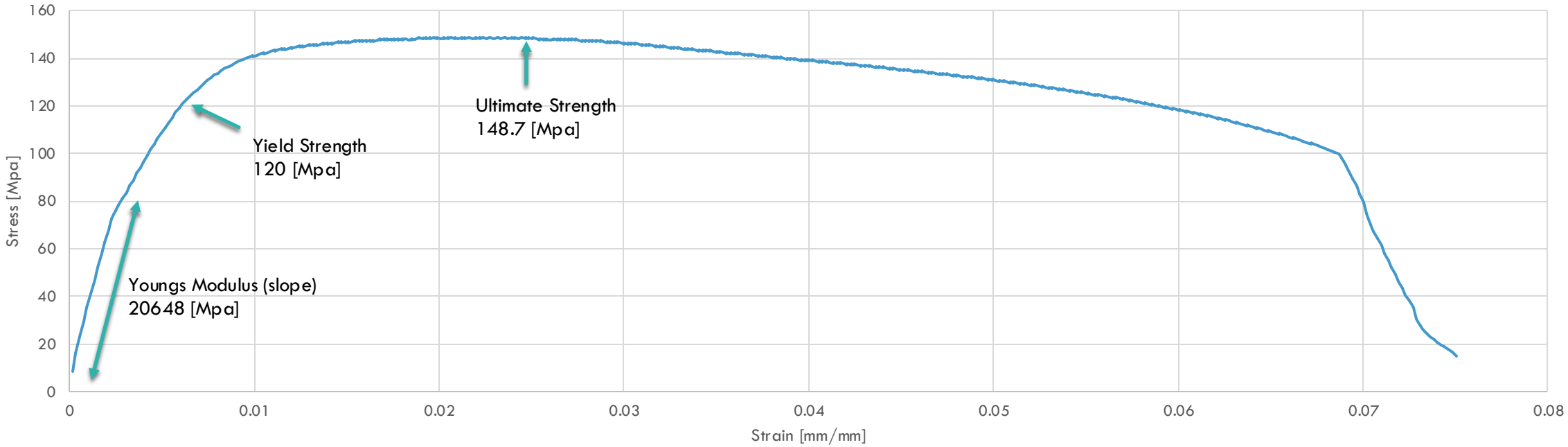


Figure 1: Sample 1 AL 3003

Sample	Young's Modulus (MPa)	Toughness (MPa)	Yield (MPa)	Ultimate (MPa)	Fracture (MPa)
1	20,648	9.24	120.0	148.7	14.8
2	18,185	8.99	72.0	144.5	14.3
3	26,814	8.17	102.5	144.8	14.4

AL 5052

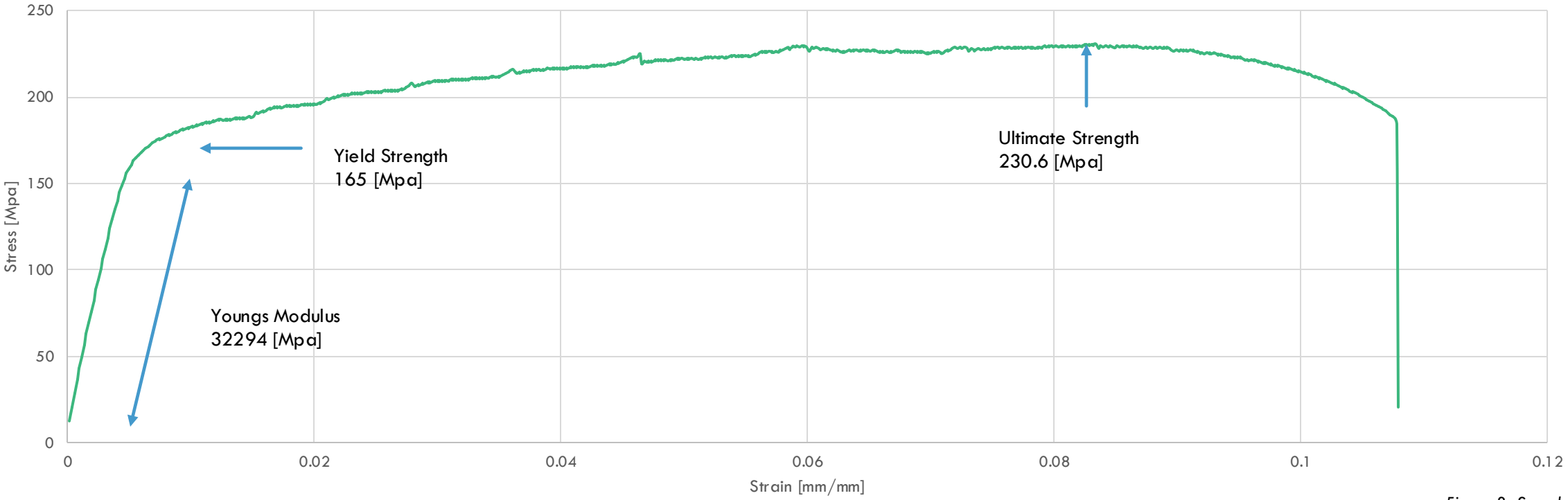
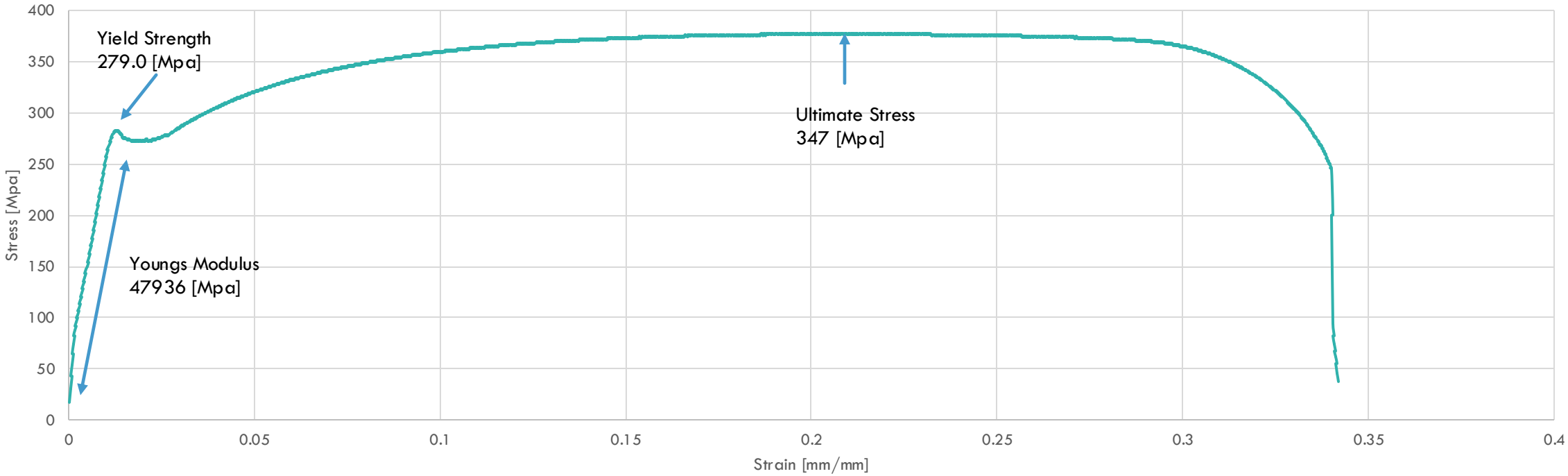


Figure 3: Sample 3 AL 5052

Sample	Young's Modulus (MPa)	Toughness (MPa)	Yield (MPa)	Ultimate (MPa)	Fracture (MPa)
1	30,621	15.12	160.0	230.1	16.7
2	32,909	15.33	164.0	230.7	21.6
3	32,394	15.27	165.0	230.6	20.5

STEEL



Sample	Young's Modulus (MPa)	Toughness (MPa)	Yield (MPa)	Ultimate (MPa)	Fracture (MPa)
1	59916.88	22.60	277.0	348.29	36.98
2	47936.09	21.83	279.0	347.22	37.07
3	47378.60	21.60	275.0	343.82	36.99

Figure 4: Sample 2 Steel

MDF FACTOR OF SAFETY

- • **Mean Yield Strength**: 17.02 MPa
- • **Standard Deviation**: 1.45 MPa
- • **99% Safe Yield Strength**: 13.65 MPa
- • **Factor of Safety**: 1.25

- This means that the yield strength at which 99% of the MDF samples will not fail is approximately 13.65 MPa, with a factor of safety of 1.25 between the average yield strength and this safe value.

Yield Strength of Steel

DEFINITION:

YIELD STRENGTH IS THE STRESS AT WHICH A MATERIAL BEGINS TO PLASTICALLY DEFORM.

CHARACTERISTICS OF STEEL:

YIELD POINT PHENOMENON: MANY STEELS EXHIBIT A SHARP YIELD POINT

Typical Yield Strength Values:
Low Carbon Steel: 250-395 MPa
Medium Carbon Steel: 310-530 MPa
High Carbon Steel: 420-620 MPa
Structural Steel (A36): 250 MPa

Comparison to Lab Tests:
The data taken from the tensile test lab shows that this is most likely a Low Carbon Steel as their Yield Strength Values closely confide. The sharp yield point is also visible in the Stress Strain Plot *Figure 4*