EGR 270 – Materials Science Laboratory
Communication and Display of Data – Worksheet 1

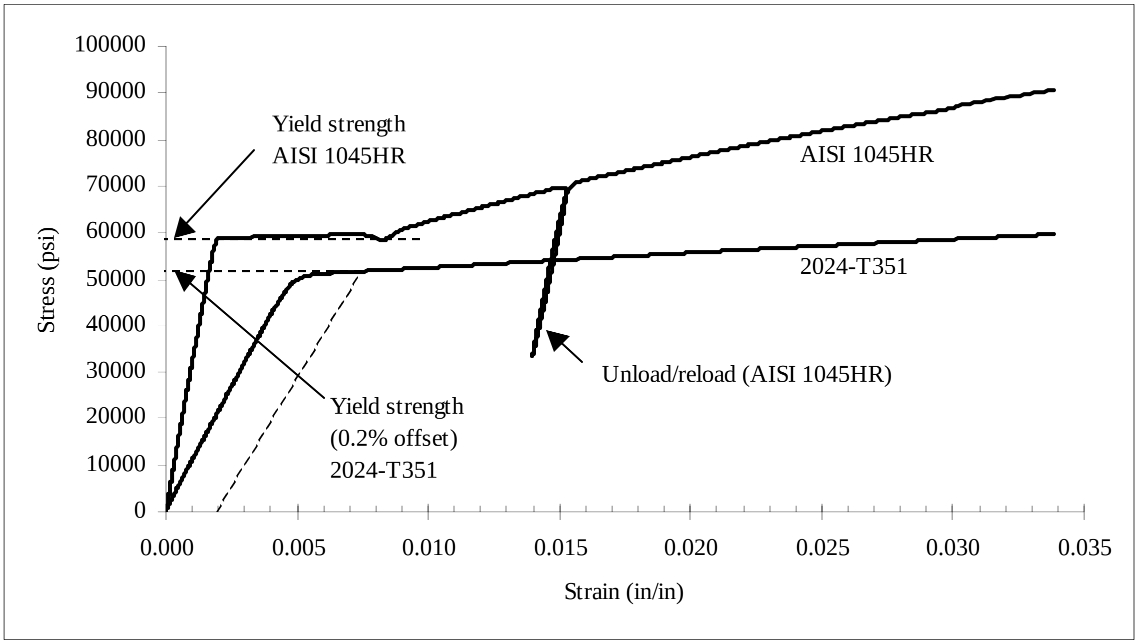

Figure 1 – Stress-strain diagram for two different materials.

1. *Download the Excel file "WorkSheet1-Stress-Strain" from Lulay's course web page. It contains data from two stress-strain tests (one for 2024-T351 aluminum and one for AISI 1045HR steel). The original diameter of both bars was 0.505 inches. The data collected includes load (force) and strain, as well as other "extraneous" data. As an example, the data for the aluminum specimen has been manipulated so as to be able to create a stress-strain curve by plotting the "stress and strain" columns. The data for the steel is "raw" – it has not been manipulated yet.*

   Reproduce the graph above exactly (this is an exercise in formatting as well as data manipulation).

Check list (to be used as such):

- This is an xy-scatter plot, ***not*** a line graph!
- All of the text on this graph is sufficiently large (approximately 10 point Times New Roman
- There are no gridlines
- The background color is white (clear) not gray
- There are no data markers, all lines are black.
- The weight of the lines for the data is heavier than the dashed lines used for determining yield strength
- The data sets are indicated with text (eg. 2024-T351, AISI 1045HR).
- Both axes are properly labeled with a description (Stress, Strain) and the units of measure (psi, in/in).

The following is a list of questions and tabulated data that was collected to help answer the question posed. For each of these questions and supporting data, make a graph, table, or other figure to communicate the results in a meaningful manner. Consider how the data should be presented to most effectively communicate the answer the question. For your convenience, the data may be downloaded from the course web page. HINT: None of these should be "line graphs."

2. *The purpose of this laboratory was to determine the stiffness (modulus of elasticity) of various pure metals.*

Metal	Modulus of Elasticity (GPa)
Aluminum	69
Copper	115
Gold	77
Molybdenum	320
Tin	44.3
Titanium	103

3. *The purpose of this laboratory was to determine the effect of carbon content on the hardness of martensitic plain carbon steel. Hint, per AISI standards, the first two digits inform us about the alloy content and the second two digits are the carbon content. For example, AISI 1040 steel, the first two digits (10xx) tell us it is plain carbon steel (no additional alloying elements other than carbon and iron) and the last two digits (xx40) tell us there is 0.40 wt% carbon. AISI 1090 steel is also a plain carbon steel, but has a 0.90wt% carbon content.*

Steel	Hardness (BHN)
AISI 1010	350
AISI 1020	505
AISI 1040	610
AISI 1060	615
AISI 1080	685
AISI 1095	695

4. *The purpose of this laboratory was to determine the effect of tempering time on the hardness of AISI 1080 steel.*

Time (sec)	Hardness (RC)
10	48
100	44
1000	40
100000	33

5. *The purpose of this laboratory was to determine the effect of temperature on the yield strength of AISI 1040 steel. Three tensile bars were tested at each temperature.*

Test Temp. (°C)	Yield strength (MPa)	Yield strength (Mpa)	Yield strength (MPa)
205	581	602	595
315	578	597	605
425	557	561	538
540	498	491	481
650	441	424	438

6. *The purpose of this laboratory was to determine the effect of carbon content on the strength and ductility of plain carbon steel.*

Steel	Tensile Strength (MPa)	Yield Strength (MPa)	Ductility (50 mm gage length)
AISI 1015	424	324	37.0
AISI 1020	441	347	35.8
AISI 1030	521	345	32.0
AISI 1040	590	374	28.0
AISI 1050	748	428	20.0
AISI 1060	776	421	18.0
AISI 1080	1010	524	11.0
AISI 1095	1014	500	9.5