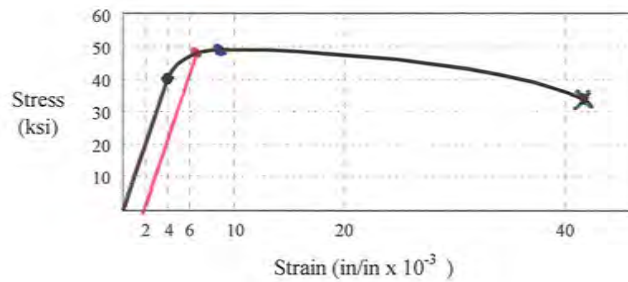


Worksheet 3A  
Stress-Strain Curves



1. Using the stress-strain curve above, determine:

- A. The proportional limit stress. **40 ksi**
- B. The yield stress (0.2% offset). **48 ksi**
- C. The ultimate strength. **49 ksi**
- D. The rupture stress. **32 ksi**  $E = 42 \cdot 10^{-3} \text{ in/in}$
- E. The Modulus of Elasticity.

$$E = \frac{\sigma}{\epsilon} = \frac{20}{.002} = 10,000 \text{ ksi}$$

2. During a tension test on a 1/2" diameter specimen (2" gage length), you record the force = 3000 lbs, the axial deformation =  $30.5 \times 10^{-4}$  inches, and the diameter is now 0.4998 inches. What is Poisson's Ratio for this material?

$$\begin{aligned} P &= 3000 \text{ lbs} \\ \delta &= 30.5 \cdot 10^{-4} \text{ inches} \\ L_0 &= 2.0 \text{ inches} \end{aligned}$$

$$\epsilon_{\text{long}} = \frac{\delta}{L_0}$$

$$\begin{aligned} \epsilon_{\text{long}} &= \frac{30.5 \cdot 10^{-4}}{2.0} \\ &= 1.525 \cdot 10^{-3} \end{aligned}$$

$$\epsilon_{\text{lat}} = \frac{\delta}{\text{initial}}$$

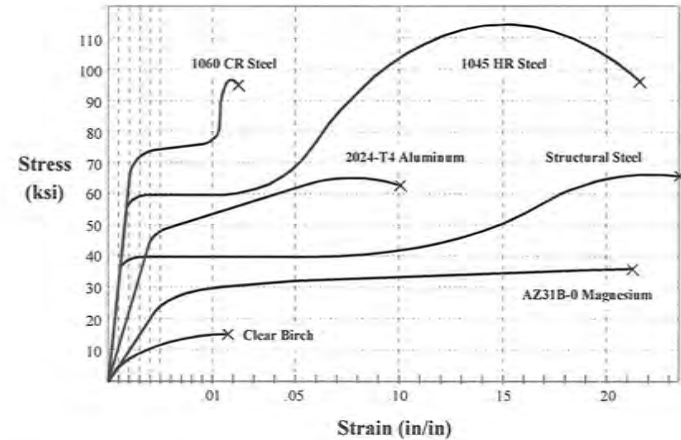
$$\begin{aligned} \epsilon_{\text{lat}} &= \frac{(.5 - .4998)}{.5} \\ &= -4 \cdot 10^{-4} \end{aligned}$$

$$\nu = - \frac{\epsilon_{\text{lat}}}{\epsilon_{\text{long}}}$$

$$\nu = - \frac{-4 \cdot 10^{-4}}{1.525 \cdot 10^{-3}}$$

$$= \underline{\underline{0.26}}$$

Worksheet 3B  
Material Properties



Using the stress-strain curves above, determine:

- A. Young's modulus for 1060 CR Steel.  **$30/.001 = 30,000 \text{ ksi}$**
- B. The ultimate strength of 1045 HR Steel. **113 ksi**
- C. The proportional limit of 2024-T4 Aluminum. **45 ksi**
- D. The yield point of Structural Steel. **39 ksi**
- E. The yield stress (based on 0.2% permanent offset) for 2024-T4 Aluminum. **50 ksi**

F. Which of these materials is the strongest? Why?

1060 CR Steel

2024-T4 Aluminum

AZ31B-O Magnesium

G. Which of these is the most ductile material? Why?

Structural Steel

1045 HR Steel

AZ31B-O Magnesium

H. Which of these is the most brittle material? Why?

2024-T4 Aluminum

1060 CR Steel

1045 HR Steel

I. Which of these materials is the most resilient? Why?

1060 CR Steel

1045 HR Steel

Structural Steel

J. Which of these is the toughest material? Why?

Structural Steel

1060 CR Steel

1045 HR Steel

K. Which material is the stiffest? Why?

1060 CR Steel

2024-T4 Aluminum

Clear Birch