دانشگاه صنعتی اصفهان ، دانشکده مهندسی مواد

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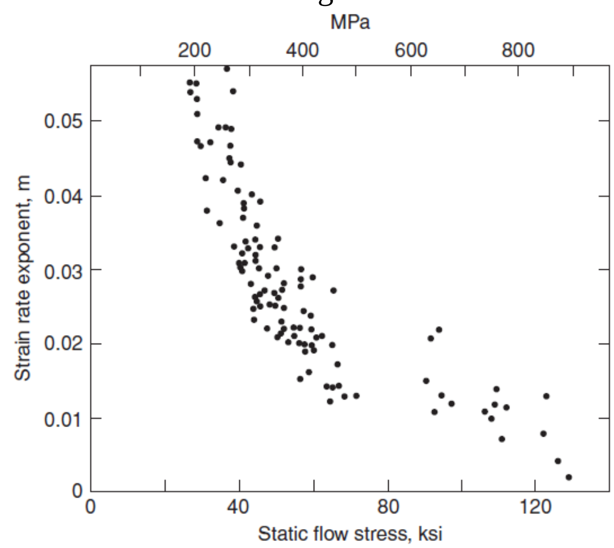
1- The strain-rate dependence of a zinc alloy can be represented by equation $\sigma = C\dot{\varepsilon}^m$ with $m = 0.12$. What is the ratio of the flow stress at $\varepsilon = 0.2$ for a strain rate of 10^2 /s to that at $\varepsilon = 0.2$ for a strain rate of 10^{-3} /s? Repeat for a low carbon steel with $m = 0.03$.

2- During a tension test the strain rate was suddenly doubled. This caused the load (force) to rise by 5%. Assuming that the strain-rate dependence can be described by $\sigma = C\dot{\varepsilon}^m$, what is the value of m?

3- Low-carbon steel is being replaced by HSLA (High Strength Low Alloy) steels in automobiles to save weight because the higher strengths of HSLA steels permit use of thinner gauges. In laboratory tests at a strain rate of about 10^{-3} s^{-1}, one grade of HSLA steel has a yield strength of 395 MPa with a strain-rate exponent m = 0.015, while for a low-carbon steel, Y = 280 MPa and m = 0.028. Calculate the percent weight saving possible for the same panel strength assuming

a) a strain rate of 10^{-3} s^{-1}, **b)** crash conditions with a strain rate of 10^{+4} s^{-1}.

4- For steel and other bcc metals, strain rate sensitivity is better described by $\bar{\sigma} = C + m' \ln \dot{\varepsilon}$. Find the value of m' in this equation that best fits the data in figure.



5- Evaluate m for copper at room temperature from the figure.