Strain Rate Effects

• Lowest range of strain rates ⇒ Creep and Stress Relaxation
• Intermediate range $10^{-4} < \varepsilon < 10^{-2} ⇒$ Hot working/Tensile test
• Highest range ⇒ shock wave or explosive test

• Stress-strain curves can be sensitive to strain rate $\dot{\varepsilon}$
  – flow stress increases with strain rate
  – work hardening rate may also increase with strain rate
Two parameters, \( m \) and \( s \) used to describe the above effects are:
- Strain rate sensitivity (\( m \)), and this is given as:

\[
m = \frac{\partial \ln \sigma}{\partial \ln \dot{\varepsilon}} \bigg|_{\varepsilon,T} \tag{2.8}
\]

and

\[
s = \frac{\partial \ln w}{\partial \ln \dot{\varepsilon}} \bigg|_{\varepsilon,T} \quad \text{where} \quad w = \frac{d\sigma}{d\varepsilon} \bigg|_{\varepsilon,T} \tag{2.9}
\]