Choosing Stock

Week 1 Lecture

Stock Geometries

- Rod stock
- Sheet stock
- Plate stock
- Bar stock
- etc.

Choosing Material

- Plastics
  - HDPE
  - Delrin
  - ABS
- Metals
  - Aluminium
  - Steel

- Cost
- Weight
- Application requirements
  - Friction
  - Response to stress
- How was it made?

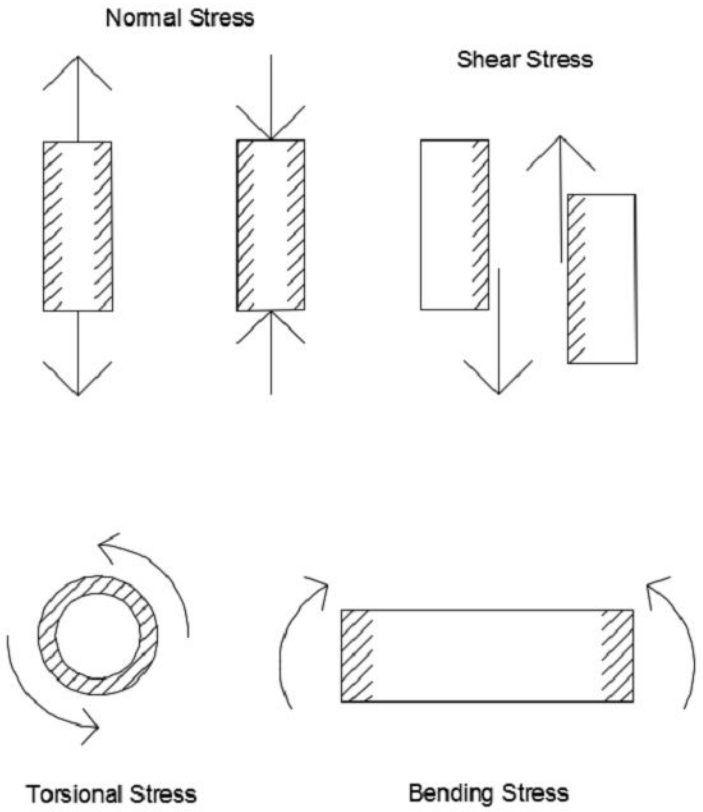
How is stock made?

- Cold-roll forming: rolled below recrystallization temperature
  - Better strength and surface finish
    - The strength comes from strain hardening
  - Flatter than hot rolled
  - Contains residual stresses
- Hot rolling: rolled above recrystallization temperature
  - Allows for more bulk deformation while rolling
  - Cheaper than cold rolled
  - Less residual stress than cold rolled
- Extruded
  - Pushed through a die
  - Can be hot or cold
  - Cheapest
  - Thickness is the least constant

Stress and Strain

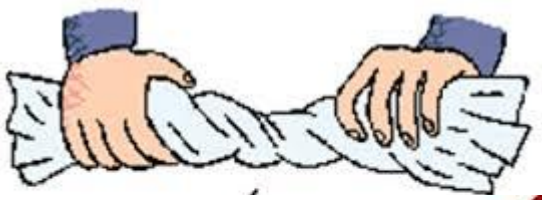
Stress: Load exerted on an object. F/A

Strain: Deformation produced by the stress. δ/L



Real World Examples

- Tensile
  - Pizza cheese
- Compression
  - Stress ball
- Shear
  - Scissors cutting
- Bending
  - Breaking a popsicle stick
  - Tensile on bottom, compression on top ie. bending over and your back skin stretching
- Torsional
  - Wringing out a wet towel
  - Causes a shear stress



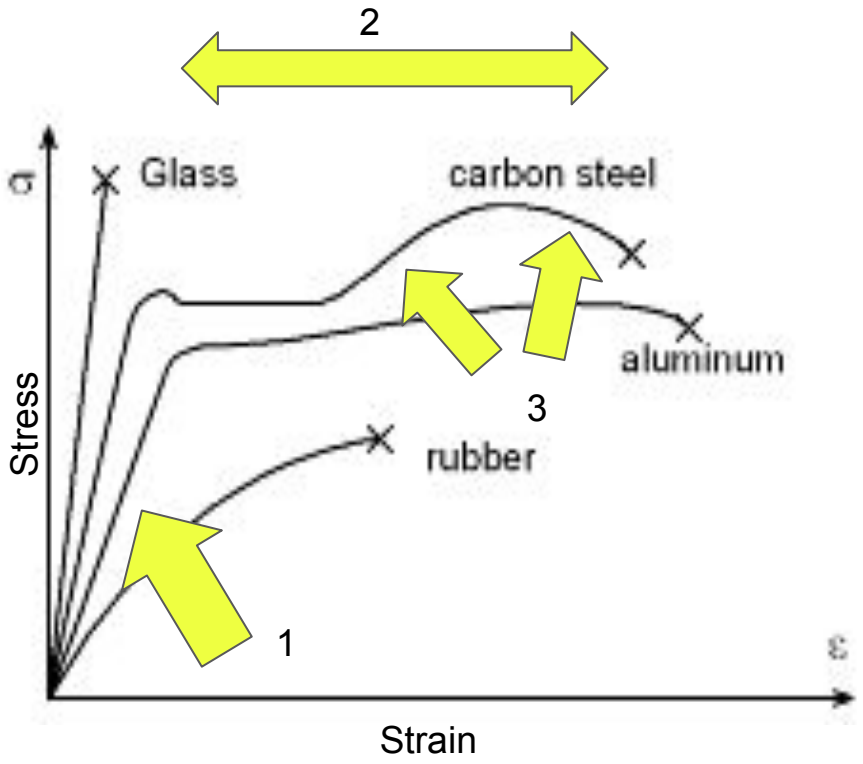
Real World Quiz

- Hitting edge of can on counter to break the middle open
- Twisting the can open to get the dough out
- Cutting the dough or tearing the dough to get the pieces

- Bending
- Torsional
- Shear or tensile

A Little Material Science

1. The initial linear section is elastic deformation
    - The material can revert to its initial state if released
2. The following section is plastic deformation
    - Deformation in this region is permanent
3. In the metals, there is a ridge in the plastic deformation section
    - The first half is strain hardening (this is what happens in cold forming), the material gets stronger
    - The second half is Poisson effect



Why is this important?

- All materials have a point after which they plastically deform and another where they break/fracture when subjected to a load
- When designing parts, think about what type of load is being applied and where
  - Adjust your design to give extra support to these areas
- When selecting materials, consider the ductility, strength, etc. required of the part and design with the material’s strengths and weaknesses in mind

CAD Guide

https://tinyurl.com/y86eh3ut

Last week's guide:

https://tinyurl.com/yb39nv5p