Lecture 21, Mar 10, 2022

Tensile Testing

- Recall that a stress strain curve has a linear region, then flattens out and then curves down before breaking
  - The peak of this curve is the *ultimate tensile stress*
- The curving down happens because of *necking*
  - One part of the sample is slightly weaker, so when it stretches the cross section reduces more, creating a positive feedback loop and the entire material breaks at that point
- A conventional tensile specimen (a dogbone specimen) has 2 large grip regions at the ends, a reduced section in the middle that actually deforms, and sometimes a strain gauge measuring the gauge length to measure strain
- Metals deform plastically by movement of edge dislocations, instead of moving an entire plane, because this way only one line of bonds need to be broken at once instead of an entire plane
- When a material is stretched beyond its yield point and then allowed to recover, the elastic recovery has the exact same slope, i.e. the Young's modulus is unchanged
  - When the material is put under stress again the yield point is now slightly higher
- Often in real life testing the yield point isn't exactly clear; the convention for yield point in this case is to draw a line from 0.2% strain with the same slope, and the yield point is when this line intersects the curve
- Different materials have different stress-strain curves:
  - Ceramics are brittle so they have a stiff linear section and then abruptly breaks
  - Polymers are considerably less stiff and can have considerably larger strain before breaking