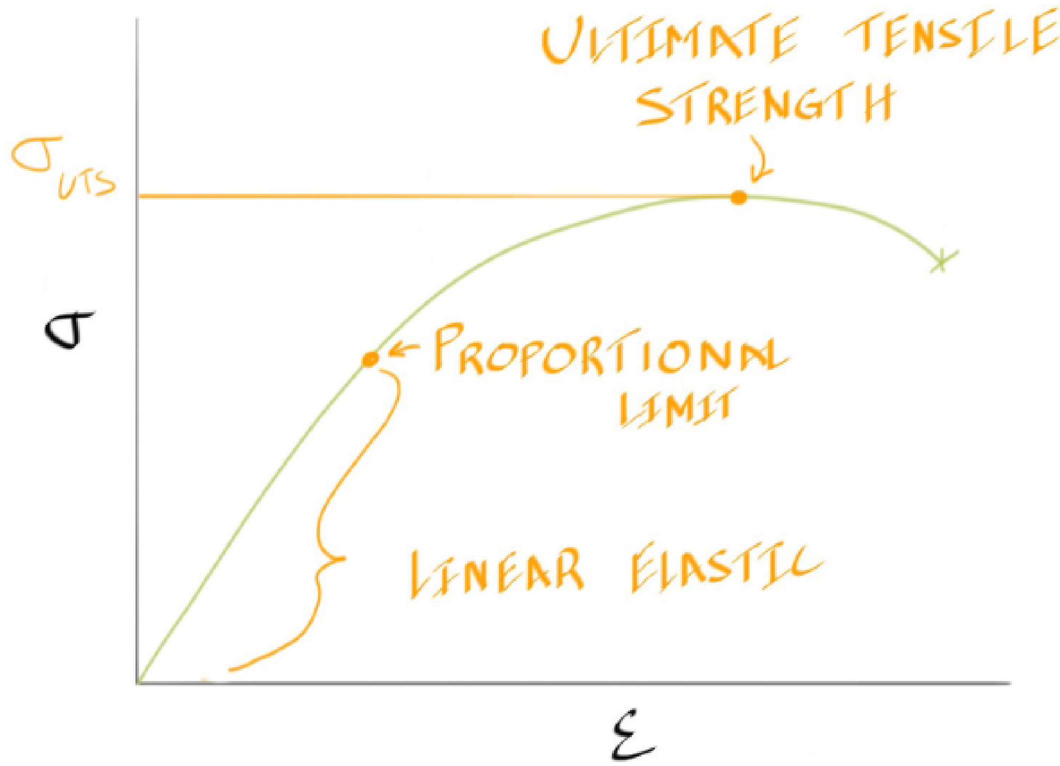
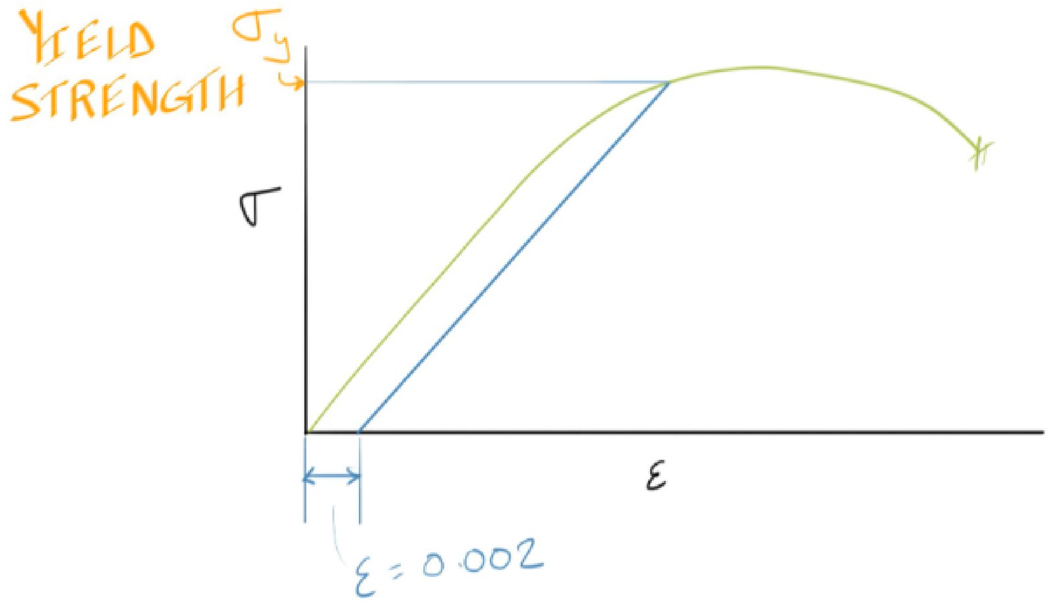
- **<u>Chapter 6: More Technical with mechanical behavior</u>**



- ULTIMATE TENSILE STRENGTH: the maximum stress that a material can withstand while being stretched or pulled before breaking.
- PROPORTIONAL LIMIT: approximately where plastic deformation begins



- YIELD STRENGTH: the point where, we assume plastic deformation begins and also is where on a metallic stress-strain curve the stress-strain behavior stops being linearly proportional.
    - *To determine the 0.2% offset yield strength we begin from a strain of 0.002 (note: (0.002)(100%) = 0.2%) and draw a line parallel to the original curve, or with the same slope as the Young's modulus of the metal being tested. Where this line intersects the curve is where we define the yield strength*

- UNIFORM AND NON-UNIFORM DEFORMATION:

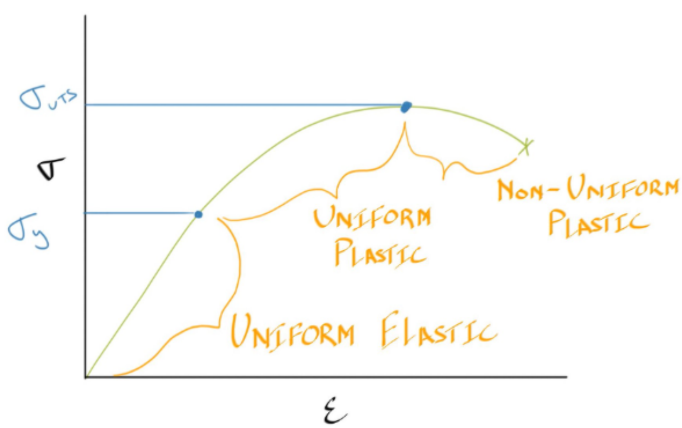


Figure 3: The generalized stress-strain behaviour for a metallic sample loaded in tension showing the regions of uniform elastic, uniform plastic, and non-uniform plastic deformation.

- Deformation is uniform until the ultimate tensile strength
- deformation is elastic until the yield strength and then plastic deformation begins.

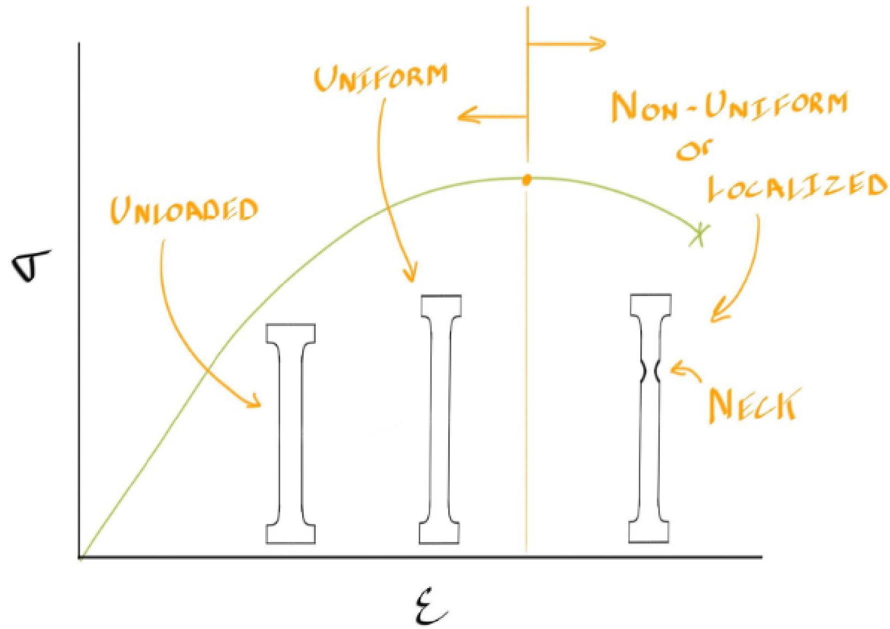


Figure 4: The generalized stress-strain behaviour for a metallic sample loaded in tension showing the sample geometry in the regions of uniform elastic, uniform plastic, and non-uniform plastic deformation.

- As a metal sample is loaded to progressively higher values of stress, eventually it will begin to fail.
- In tension, this begins when a few bonds break between metal atoms.
- this would occur randomly anywhere within the reduced section.
- Several regions of these few broken bonds will eventually come together and form a larger crack that eventually progresses to a larger crack leading to the final fracture event when the sample breaks into two pieces.
- Microscopically we observe that somewhere within the reduced section we see a sudden narrowing of the cross-sectional area. (NECKING)
- The cross-sectional area in the neck is reduced and although the metal itself does continue to get stronger within the neck, it does not strengthen as rapidly as the cross-sectional area is decreasing.
- The initial cross-sectional area is a constant and as the actual cross- sectional area decreases rapidly the force required to continue elongating the sample decreases and so we observe the engineering stress decreasing after the onset of necking, at the UTS.