

## Wirework

Most metals can be formed into wire of different diameters and cross sections. Wire is used for many purposes, jewelry was probably the first application. Modern wire production grew out of multiple needs, large and small. One was in the transmission, power conversion and utilization of electricity, copper has excellent properties for electrical jobs. Steel wire is used for small parts, such as clocks and watches, larger wires for suspension bridges and elevators. Jewelers can purchase wire in gold, silver and a dozen other alloys.

### Strength of Materials

Metals often demonstrate a clear transition from elastic to plastic deformation. They will bend and recover to the initial point (elastic bending – straight line on graph) unless they are bent too far, in which case the metal yields and the part fails to return completely. Metals that are quite hard, either from alloy or treatment are brittle, they will fail like a crystal – all at once. Other metals yield more gradually and quickly become harder and more resistant to additional bending. Copper is a prime example. Many metals can be annealed, when heated to the proper temperature the material recovers its ductility.

In addition many metals exhibit fatigue characteristics – cyclical motion causes failure at loads well below the one time yield curve.

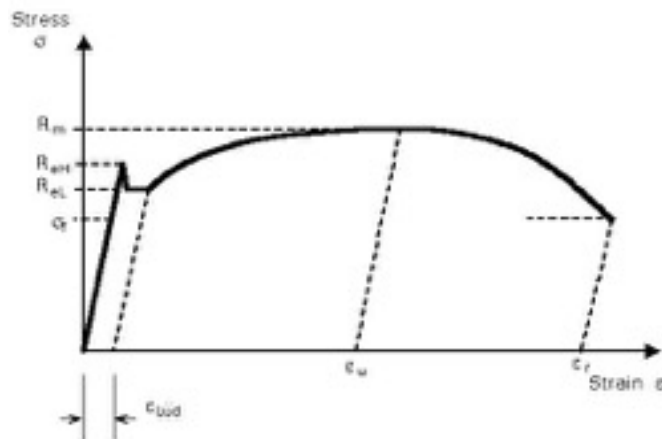


Figure 6 Engineering stress-strain curve of a metal, e.g. mild steel, with a yield point

*Discuss stress-strain curve. Demonstrate copper wire winding and work hardening.*

## **Materials**

Carbon steel

**low cost, springs, small parts**

Stainless and alloy steels

strong, resists corrosion, dental wires

Copper

best beginner metal for wirework

Silver, gold

expensive

Titanium, Niobium

used for allergy, hard and difficult to work

Tungsten

used for heating elements in vacuum tubes, welding

Nichrome

used as heater wire (toaster)

Thermocouple wire

specialized metals to measure temperature

## **Forms**

Wire is typically provided on a spool, with very uniform surface finish and temper (hardness). Circular section is most common but square, half round and other shapes are available in copper and precious metals. Custom shapes are also possible. Thick wire can also be imprinted along the length, see the Rio Grande catalog.

Standard circular gauge sizes (AWG). 6 step jump doubles diameter, 3 step jump doubles area (mass), 2 step jump doubles stiffness.

Stranded, plated wires.

## **Fabrication methods**

squeezing, bending, twisting, drawing, and shearing

*Demonstrate squaring up a wire.*

*Demonstrate braiding wire.*