Surgical Instruments

Iron (Fe)

- Crystalline Structure
  - Atoms arranged in a lattice

- Ferrite
  - < 910° C

- Austenite
  - 910°-1400° C

- Melting point
  - 1540° C

Steel

- Iron Alloy
  - Fe + Other atoms
  - At least 50% Fe

- Stainless steel
  - 11% to 30% Cr
  - Up to 2% C
Atomic Structure of Iron Crystal

Body Centered

Ferrite (\(\alpha\) iron)
- Magnetic
- 910° C (threshold temp)

Face Centered

Austenite (\(\gamma\) iron)
- Non-magnetic
- Larger interstitial gaps

Alloys - Substitutional Atoms

- Same size as Fe
- Replace Fe atoms
  - Chromium (Cr)
  - Molybdenum (Mo)
  - Nickel (Ni)
Alloys - Interstitial Atoms

- Smaller than Fe
- Occupy gaps
- Greater solubility in Austenite
- Precipitate out during cooling
  - Carbon (C)
  - Nitrogen (N)

Iron Alloy Atoms

**Substitutional Atoms**
- Chromium (Cr)
  - Corrosion Resistance
- Molybdenum (Mo)
  - Extra corrosion resistance
- Nickel (Ni)
  - Stabilizes Austenite
    - at room temp
  - Bright finish

**Interstitial Atoms**
- Carbon (C)
  - Smaller atomic radius than substitutional atoms
- Nitrogen (N)
  - Smaller atomic radius than C
  - Greater solubility than C
Hardening

- **Quench Hardening**
  - Heat to Austenite (face centered / higher C solubility)
  - Add Carbon
  - Cool rapidly in oil bath
    - Rapid transition to Ferrite traps C atoms
    - Excess C atoms disorganize crystal
  - Martensite
    - Disorganized Ferrite (due to trapped C atoms)

- **Work Hardening**
  - Hammer
  - Bend

Softening

**Tempering**

- Heat Martensite
  - High temperature / short time
  - Austenite surface / Martensite core

- Cool slowly
  - C precipitates from surface
  - Ferrite surface / Martensite core
  - Ductile surface (impact resistant)
  - Small sacrifice in overall hardness

**Annealing**

- Heat Martensite
  - Austenite throughout

- Cool slowly
  - Carbon precipitates out
    - 0.00005% to 2% (by weight)
  - Ferrite throughout
  - Ductile
Classes of Stainless Steel

- Ferrite
  - Fe + Cr
  - Magnetic
  - Ductile
  - Low Cost

- Martensite
  - Fe + Cr + (C / N)
  - Magnetic
  - Hard
  - Maintains sharp edge

- Austenite
  - Fe + Cr + Ni (+ C / N)
  - Non-magnetic
  - May be quench hardened
  - Not as hard as Martensite

- Other
  - Manganese-Substituted Austenitic
  - Duplex Austenitic-Ferritic
  - Precipitation Hardened

Dissecting Forceps

- Micro-Dissecting (normally open)
- Cross Action (normally closed)

- Adson
- Cushing
- Jansen
- Alligator
Hemostats (Clamps)

- Kelly - sturdy
- Reynolds - sturdy
- Mosquito - delicate
- Mixter - delicate

Scissors

- Mayo - sturdy
- McPherson-Vannas
- Metzenbaum - delicate
Scissors

- Sharp
- Blunt
- Sharp-blunt
- Curved
- Curved (side)
- Angled

Retractors

- Rake
- Senn
- Weitlaner
- Davis
- Barraquer
Scalpels

#3
#4
#7

Round

Miniature

Needle Drivers

Webster

Olsen-Hegar
Driver/Scissor Combo
Needles

Cross-Sections
Top = inside edge
Btm = outside edge

Most common
Reverse cutting
Conventional cutting

Tough tissue
Diamond Point
Blunt
Taper

Ophthalmic / micro-surgery
Lancet
Inverted lancet
Spatula