

Mineral Properties in Hand Specimen

Luster

- Metallic
- Sub-metallic
- Non-metallic
- Vitreous
- Adamantine
- Resinous
- Greasy
- Silky
- Pearly
- Dull
- And many others

Adamantine (to sparkle and appear brilliant like diamond)

Diaphaneity (ability to transmit light)

- Transparent
- Translucent
- Opaque

Color

- Chromophores
 - Elements that give minerals color
 - Mainly transition metals (Fe, Ti, Cr, Mn, etc.)
- Idiochromatic ("self"-coloring)
 - Major or "necessary" elements determine color
 - More likely to be useful for identification
- Allochromatic ("other"-coloring)
 - Minor or trace elements determine color
 - Ruby red is from trace Cr in corundum (Al_2O_3)
 - Sapphire blue is from trace Fe and Ti in Al_2O_3

Staurolite is idiochromatic

- Fe gives staurolite its brown color
- Staurolite formula is $\text{Fe}_2\text{Al}_9\text{Si}_4\text{O}_{23}(\text{OH})$

Rhodochrosite is idiochromatic

- Mn gives rhodochrosite its cherry red color
- Rhodochrosite formula is MnCO_3

Aquamarine is allochromatic

- Trace Fe gives aquamarine its blue color
- Aquamarine is Beryl, formula $\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$

Structural defects may give quartz color

- Radiation damage causes purple (amethyst) or smoky color

Streak is a useful diagnostic property

- Color of fine powder on streak plate is more reliable than hand-specimen color
- Mineral must be softer than the streak plate (H~6.5)
- Streak is especially useful for dark, metallic minerals

Play of Colors

- Opalescence - white light is separated into many colors (opal and moonstone)
- Chatoyancy and asterism - scattering effects

Crystal Shape

- Special named shapes
 - cube Pyrite

 - dodecahedron Garnet

 - octahedron Magnetite

- General Shapes
 - prismatic
 - platy
 - blocky
 - tabular
 - bladed

Crystal Habit (in aggregates)

- massive

- granular
- radiating
- acicular
- fibrous
- asbestiform
- colloform or globular
- botryoidal (bubble-like)

Cleavage

- Shiny, smooth, planar breakage
- Between weakly bonded planes in mineral structure
- Sometimes hard to tell from growth faces (which commonly have imperfections, not as smooth)
- By quality
 - perfect
 - good
 - fair
- By shape or number and angle between them
 - cubic
 - rhombohedral
 - octahedral
 - prismatic

Cleavage Examples

Minerals without Cleavage have irregular Fractures

Quartz growth forms

Conchoidal fracture in quartz

Hardness (relative)

Mohs Hardness Scale

- talc H=1
- gypsum H=2
 - fingernail H=2.5
- calcite H=3
 - penny H=3.5
- fluorite H=4
- apatite H=5
 - knife, glass H=5.5
- feldspar H=6
 - file, streak plate H=6.5

- quartz H=7
- topaz H=8
- corundum H=9
- diamond H=10

Density (and Specific Gravity)

- Density (ρ) is in grams/cubic centimeter (g/cc)
- Specific Gravity (G) is mass mineral / mass water at 1atm and 4°C (~1; therefore, ρ and G values are similar; G is unitless)
- Determined by weight in water vs. weight in air

Density (or Specific Gravity)

- Relative density (or "heft") is useful for identifying some minerals
- most minerals range from G=2 to G=8
- average G non-metallic minerals ~2.7 (quartz)
- average G metallic minerals ~5 (pyrite)
- Barite (BaSO_4) with G=4.5 feels heavier than most other light colored, translucent minerals (of the same size)
- Galena (PbS) with G=7.6 feels heavier than most other metallic minerals (of the same size)

Other Useful Properties

- A few minerals are magnetic (attract a magnet) Magnetite (Fe_3O_4) and Pyrrhotite (Fe_{1-x}S)
- Some carbonate minerals effervesce (fizz) in dilute (5%) HCl: Calcite, Rhodochrosite, Aragonite; others, especially Dolomite, do not
- Fluorescence, phosphorescence, thermoluminescence or radioactivity are diagnostic for a few minerals

Twinning

- When two or more crystals of the same mineral share common atoms, typically along planes
- Twinning is characteristic of certain minerals
- Twinned crystals must be symmetrically related
- Simple twins - only 2 members or parts
- Complex twins - more than 2 members or parts
- Contact twins - share only one plane of atoms
- Penetration twins - members share a volume
- Polysynthetic twins - complex twins with parallel planes of shared atoms
- Cyclic twins - complex twins with non-parallel planes of shared atoms

Twinning (see handout for examples)