Chapter 7.3
"Metallic Bonding"

Honors Chemistry
Duxbury High School

Section 7.3
Bonding in Metals

• OBJECTIVES:
  – <u>Model</u> the valence electrons of metal atoms.

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• OBJECTIVES:
  – <u>Describe</u> the arrangement of atoms in a metal.

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• OBJECTIVES:
  – <u>Explain</u> the importance of alloys.

Metallic Bonds are...

• How metal atoms are held together in the solid.
• Metals hold on to their valence electrons <u>very weakly</u>.
• Think of them as positive ions (cations) floating in a sea of electrons: Fig. 7.12, p.201

Sea of Electrons

• Electrons are free to move through the solid.
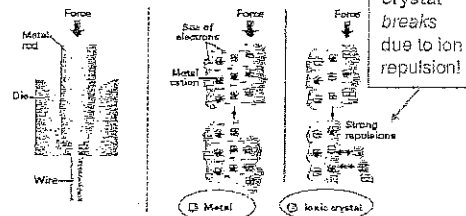• Metals conduct electricity.

Metals are Malleable

- Hammered into shape (bend).
- Also ductile - drawn into wires.
- Both malleability and ductility explained in terms of the *mobility* of the valence electrons
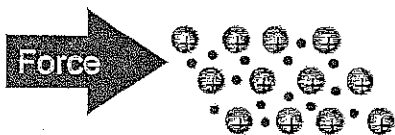

Due to the mobility of the valence electrons, metals have:

1) Ductility and 2) Malleability

Notice that the ionic crystal *breaks* due to ion repulsion!

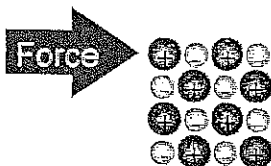---

Malleable

Malleable

- Mobile electrons allow atoms to slide by, sort of like ball bearings in oil.
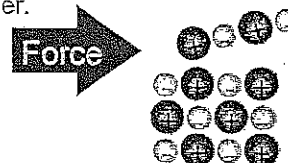

Ionic solids are brittle

Ionic solids are brittle

- Strong Repulsion breaks a crystal apart, due to similar ions being next to each other.

Alloys

- We use lots of metals every day, but few are pure metals
- Alloys are _____ of 2 or more elements, at least 1 is a metal
- made by melting a mixture of the ingredients, then cooling
     _____ : an alloy of Cu and Zn
- Bronze: Cu and Sn

Why use alloys?

- Properties are often _____ to the pure element
- Sterling silver (92.5% Ag, 7.5% Cu) is harder and more durable than pure Ag, but still soft enough to make jewelry and tableware
- Steels are very important alloys
  – corrosion resistant, ductility, hardness, toughness, cost

More about Alloys…

- Table 7.3, p.203 – lists a few alloys
- Types? a) substitutional alloy- the atoms in the components are about the same size
- b) interstitial alloy- the atomic sizes quite different; smaller atoms fit into the spaces between larger
- "Amalgam"- dental use, contains Hg

metals - characteristic

• Good conductors of heat & electricity

• Reason: Energy & e⁻ can easily flow thru the "sea of free flowing valence electrons.

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