

Greenwood & Earnshaw

2nd Edition

Chapter 5

Beryllium, Magnesium, Calcium, Strontium, Barium & Radium

Uses of the Alkaline Earth Metals

Metals - Much more dense - 2e in metallic bonding results in higher mp, bp, ΔH_{vap} , ΔH_{fus} , ΔH_{subl} harder than alkali metals but still soft.

Be - High strength, non-sparking alloys – uses limited by its toxicity - X-ray windows, neutron moderator for nuclear reactors. Relatively unreactive to H₂O, O₂

Mg - Lighter than aluminum, construction, airframes, missiles, light weight castings. Bulk metal relatively unreactive due to tough oxide layer.

Ca - Limited alloy use - oxide/nitride skin partly successful in resisting corrosion, generally too chemically reactive. Alloy with lead in low maintenance storage batteries.

Sr and Ba - too chemically reactive. Ra – Radiation Source.

Unique Behavior of Beryllium (Magnesium)

➤ Be(OH)₂ is amphoteric – Be(OH)₄²⁻

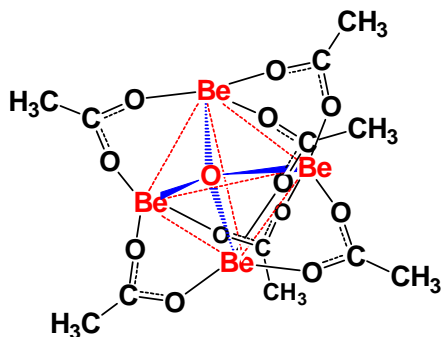
➤ BeX₂ – X = F, Cl, Br – Polymeric, linear with dative 2c-2e halogen bridge bonds.

➤ BeH₂ & MgH₂ – Polymeric with 3c-2e bonds. Ca, Sr, Ba hydrides are typical “saline” type.

➤ Be(CH₃)₂ & Mg(CH₃)₂ – Polymeric with 3c-2e bonds. Ca, Sr, Ba alkyls very ionic, less stable.

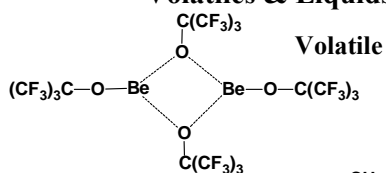
➤ Addition of MX₂ will result invariably in X-bridging; also H bridges in preference to CH₃.

Clusters – Basic Beryllium Acetate

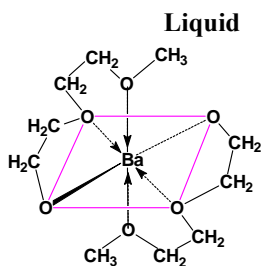


Soluble in organic solvents, insoluble in water!

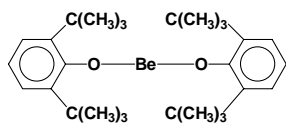
Volatiles & Liquids



Any feature which prevents the formation of a “salt” lattice will cause “ion pairs” to behave like molecules.

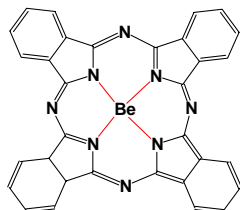


Unusual Coordination Geometries

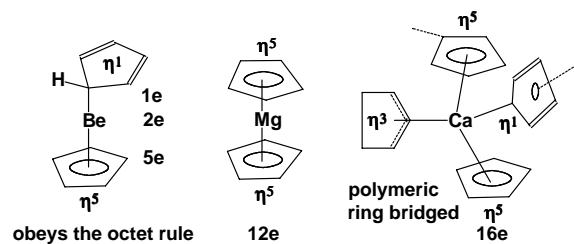


Coordination Number 2

Coordination Number 4 and Square Planar



Cyclopentadienyl Complexes



Grignard Reagents

