

# **Greenwood & Earnshaw**

**2<sup>nd</sup> 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,  $\Delta H_{\text{vap}}$ ,  $\Delta H_{\text{fus}}$ ,  $\Delta H_{\text{subl}}$  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  $\text{H}_2\text{O}$ ,  $\text{O}_2$**

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

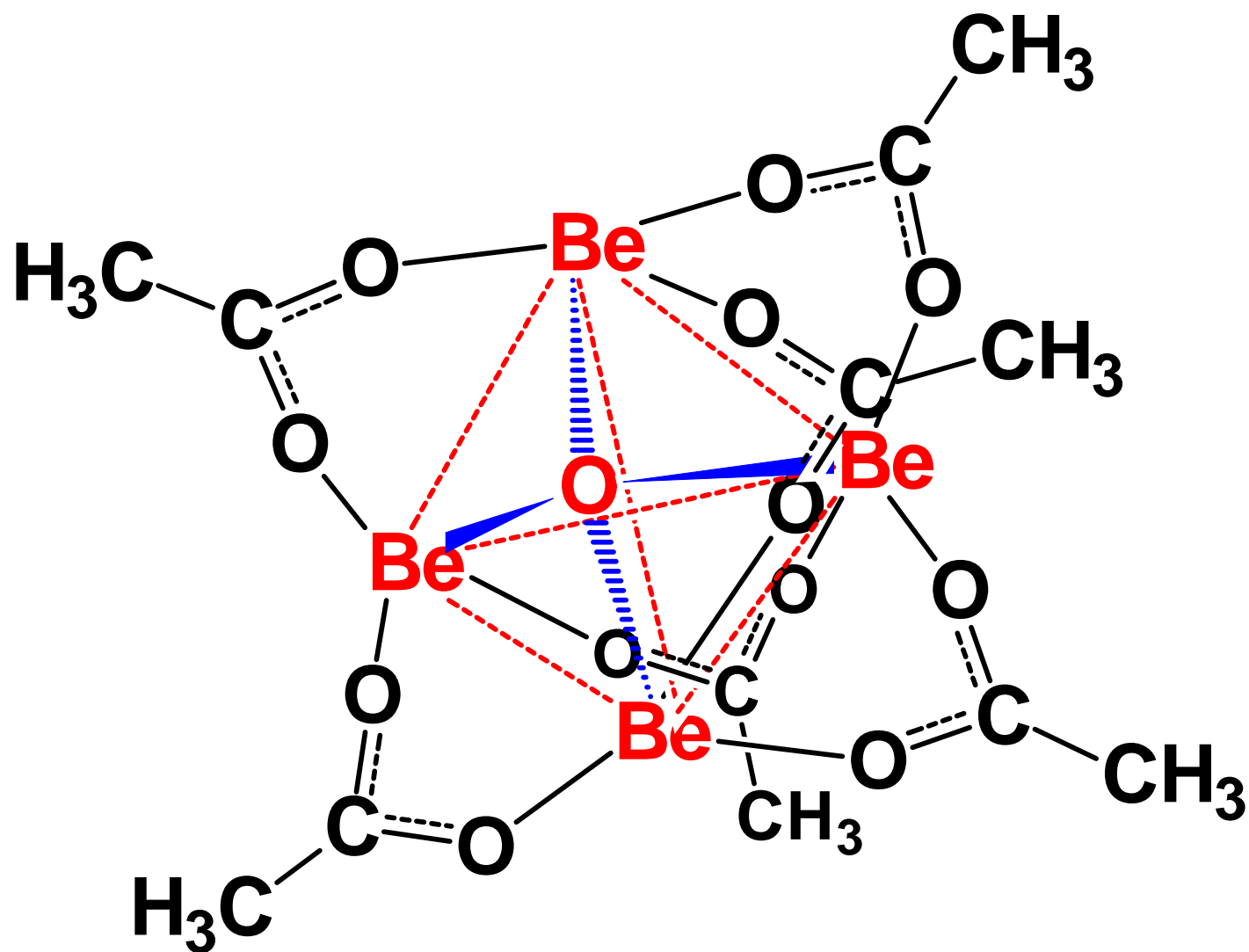
**Ca - Limited alloy use - oxide/nitride skin partly successful in resisting corrosion, generally too chemically reactive. Alloy with lead in low maintenance storage batteries.**

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

# Unique Behavior of Beryllium (Magnesium)

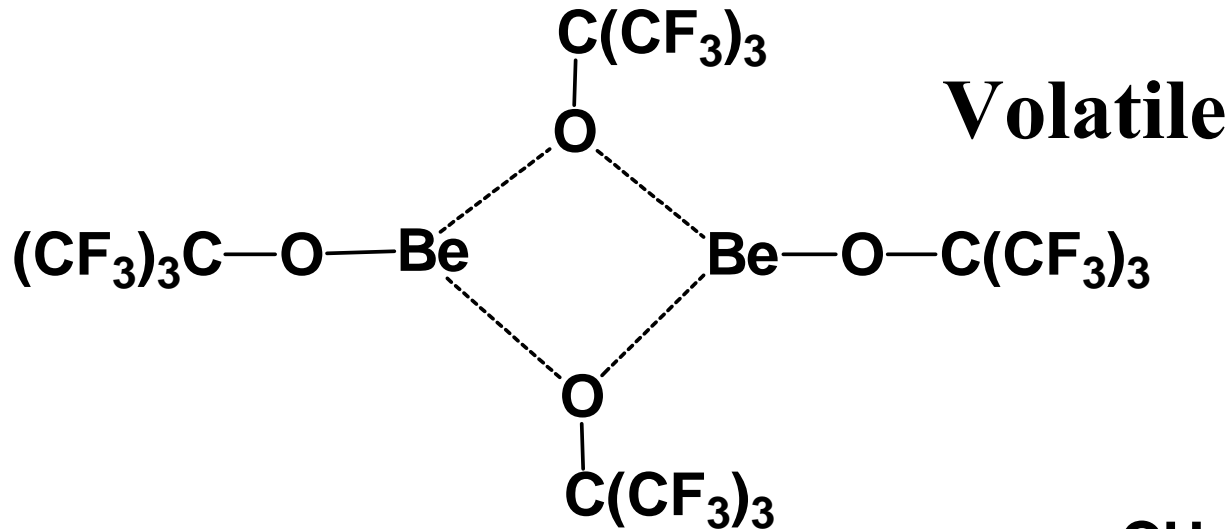
- **Be(OH)<sub>2</sub> is amphoteric – Be(OH)<sub>4</sub><sup>2-</sup>**
- **BeX<sub>2</sub> – X = F, Cl, Br – Polymeric, linear with dative 2c-2e halogen bridge bonds.**
- **BeH<sub>2</sub> & MgH<sub>2</sub> – Polymeric with 3c-2e bonds. Ca, Sr, Ba hydrides are typical “saline” type.**
- **Be(CH<sub>3</sub>)<sub>2</sub> & Mg(CH<sub>3</sub>)<sub>2</sub> – Polymeric with 3c-2e bonds. Ca, Sr, Ba alkyls very ionic, less stable.**
- **Addition of MX<sub>2</sub> will result invariably in X-bridging; also H bridges in preference to CH<sub>3</sub>.**

# Clusters – Basic Beryllium Acetate

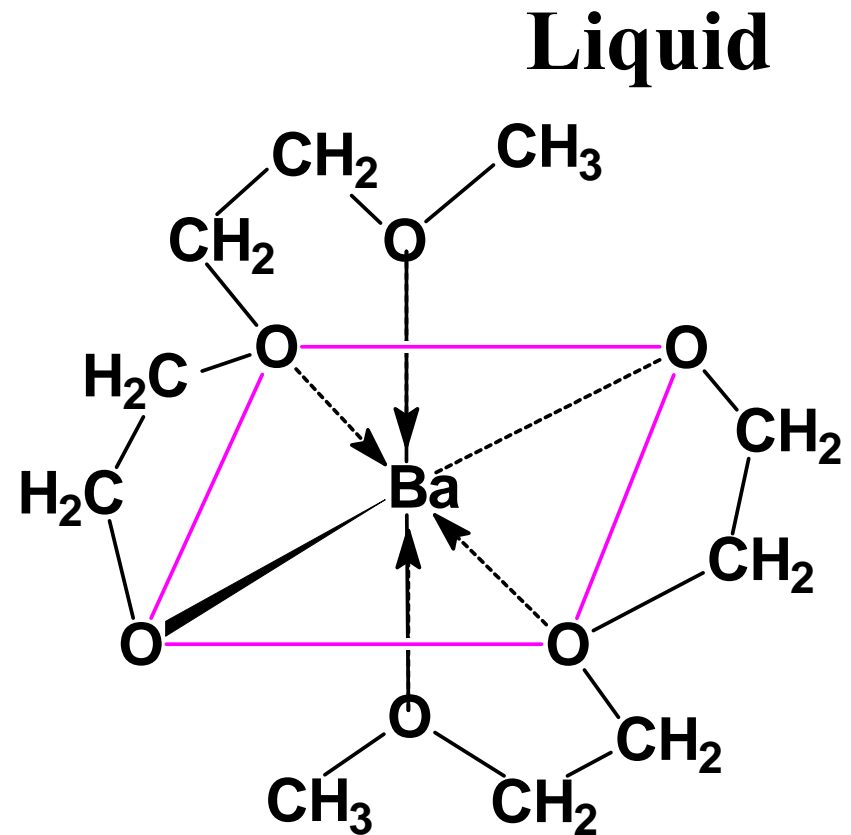


**Soluble in organic solvents, insoluble in water!**

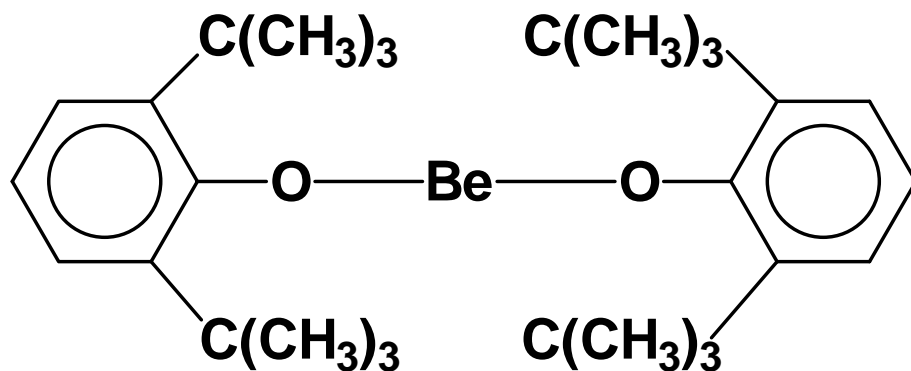
# Volatiles & Liquids



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

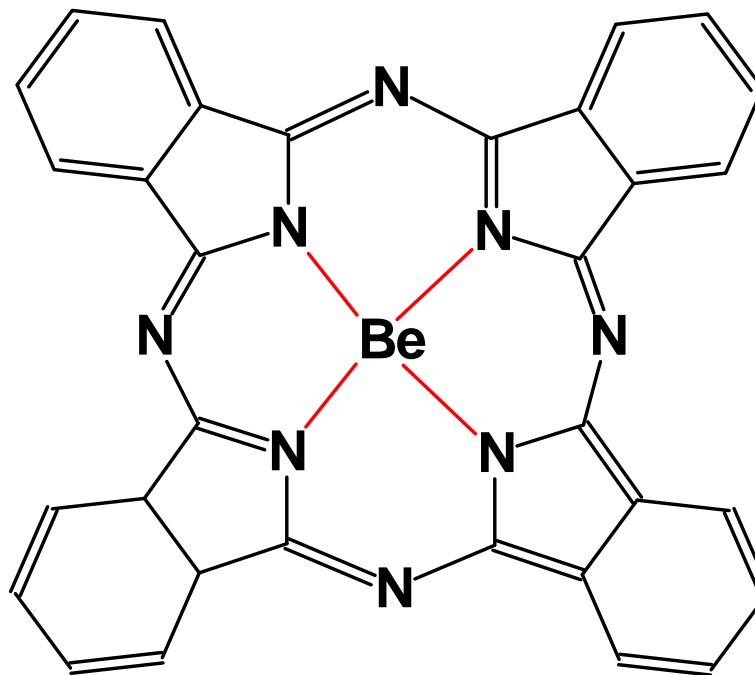


# Unusual Coordination Geometries

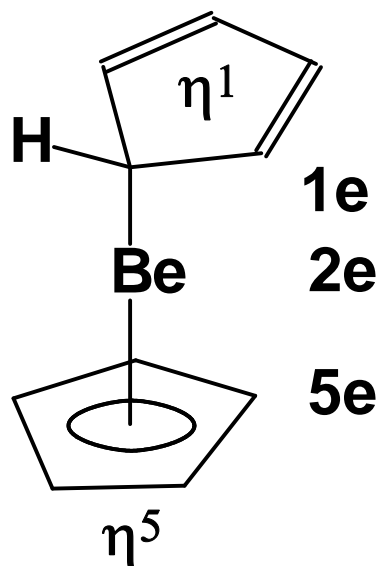


**Coordination  
Number 2**

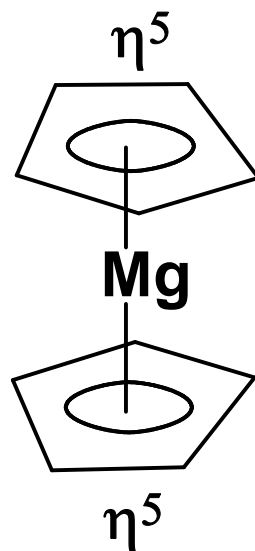
**Coordination  
Number 4 and  
Square Planar**



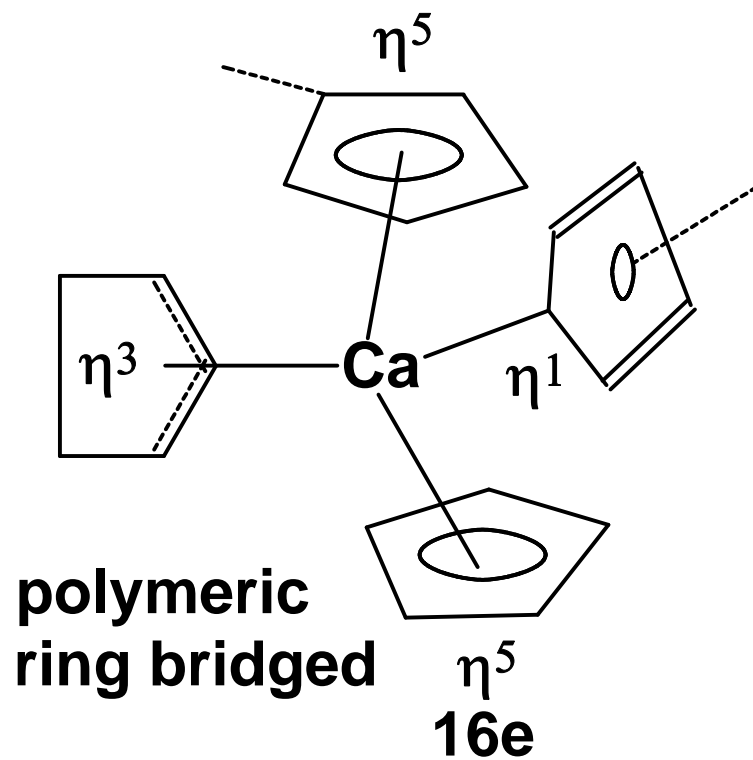
# Cyclopentadienyl Complexes



obeys the octet rule



12e



polymeric  
ring bridged

16e

# Grignard Reagents

