What is metal colloid??

Metal Colloid

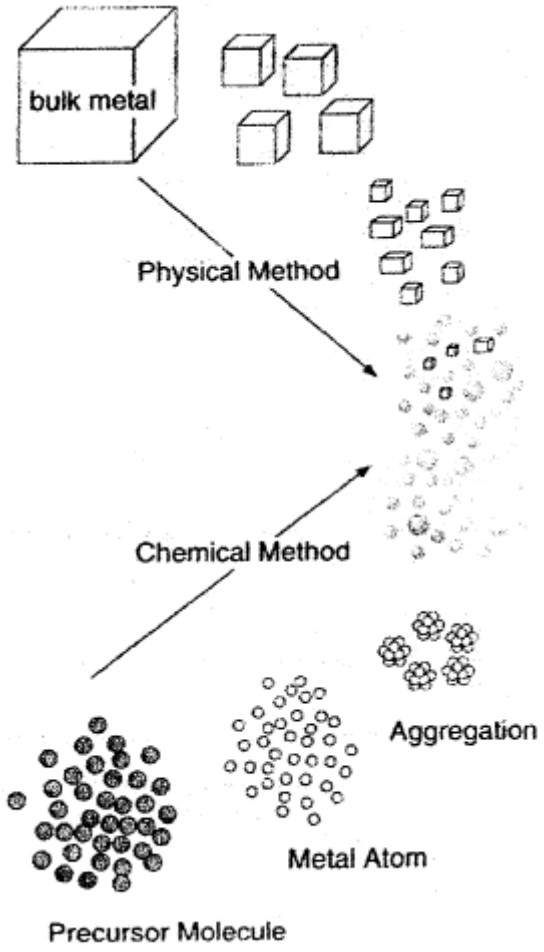
- **Colloid**
  - Suspension of a phase (liquid or solid) in another phase
  - Colloidal particles should be large enough (> 1 nm) and of relatively weak size in order not to settle out (< 1 μm)
- **Metal Colloid**
  - Suspension of metal nanoparticles in aqueous solution
  - Obtained by synthesizing metal nanoparticles dispersed in liquid phase and stabilization of the product

Metal Nanoparticles

- Metals in nanometer scale (1 – 100 nm)
- Exhibit some different properties with bulk metals, such as melting points and optical properties
- Can be applied in catalysis, photochemistry, nanoelectronics, or optics

Metal Nanoparticles

- **Preparation**
  - Mechanic subdivision of metallic aggregates (physical method)
  - Nucleation and growth of metallic atoms (chemical method)



Metal Nanoparticles

- Phyiscal methods produce particles that:
  - Larger particle sizes
  - Board particle size distribution
  - Not reproducible
- Chemical methods produce particles that:
  - Specific size
  - Well defined surface composition
  - Reproducible synthesis and properties

Synthesis of Metal Nanoparticles

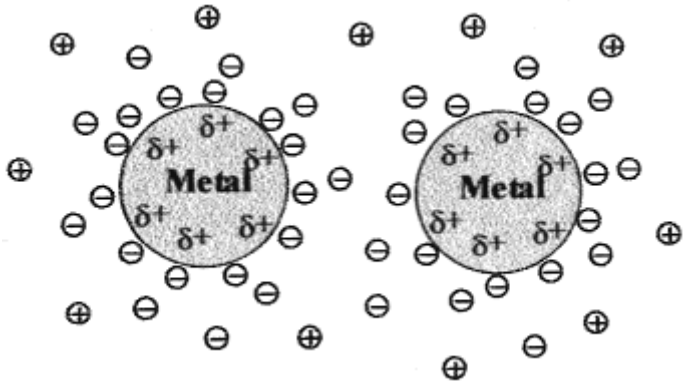
1. Chemical Reduction of Metal Salts
   - Reacting metal salts with sodium borohydride
2. Thermal, photochemical, or sonochemical decomposition
   - Radiolysis of metal salts
3. Ligand reduction and displacement from organometallics
   - Reduction of some zerovalence organometallic complexes

Synthesis of Metal Nanoparticles

4. Metal vapor synthesis
   - Co-condensation of metal vapour with organic vapour in non-aqueous media
5. Electrochemical reduction
   - Electrolysis with the presence of quaternary ammonium salt

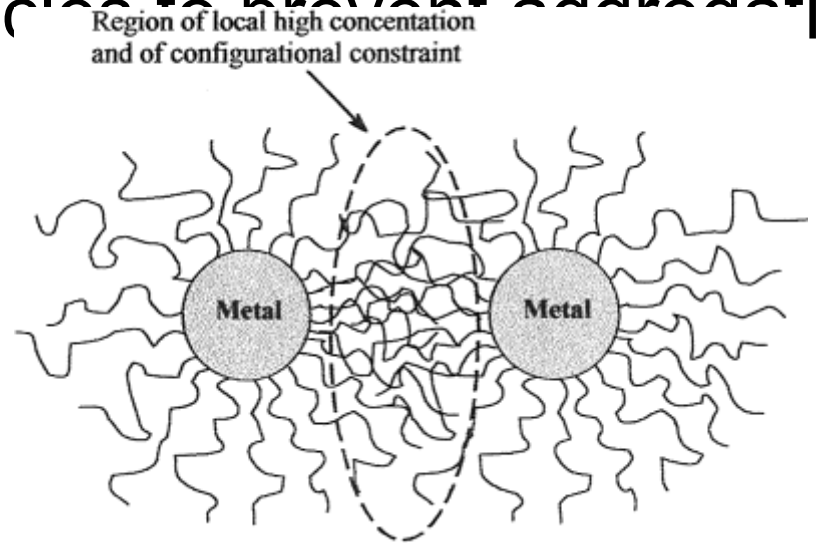
Stabilization of Metal Nanoparticles

1. Electrostatic Stabilization
   - Ionic compounds such as halides, carboxylates, or polyoxoanions, dissolved in (generally aqueous) solution
   - Generate an electrical double-layer around the particles to prevent particle aggregation



Stabilization of Metal Nanoparticles

2. Steric Stabilization
   - Macromolecules such as polymers or oligomers
   - Adsorb macromolecules at the surfaces of the particles to prevent aggregation



Stabilization of Metal Nanoparticles

3. Electrosteric Stabilization
   - Combination of electrostatic and steric stabilization
   - Ionic surfactants containing a polar headgroup able to generate an electric double layer and a lypophilic side chain able to provide steric repulsion