

5.3.SOL-GEL PROCESS OF SYNTHESIS OF NANOMATERIALS:

Sol Gel process is a wet chemical technique that uses **sol** to produce integrated network called **gel**. ‘Sol’ is a colloidal or molecular suspension of solid particle or ions in a solvent while ‘Gel’ is the semi rigid mass that is formed when solvent from sol evaporates and the particles or ions left behind join together **in a continuous network**. On drying the liquid, it is possible to obtain powders, thin films etc.

Sol can be obtained by following four steps:

- Hydrolysis of metal alkoxides and metal chlorides which act as precursors. An **alkoxide** is the conjugate base of an alcohol and therefore consists of an organic group bonded to a negatively charged oxygen atom.
- Condensation
- (Growth of particles) Polymerization of monomers to form colloids (Sol).
- Agglomeration of Colloids to form Gel.

Precursors (starting chemicals) are to be chosen such that they have a tendency to form gels. Rate of hydrolysis and condensation reactions are governed by various factors such as pH, temperature, Molar ratio, nature of precursors, concentration of catalyst and process of drying. In proper conditions spherical nanoparticles are produced. An **‘aerogel’** is obtained when the liquid phase of a gel is replaced by a gas (CO_2) in such a way that its solid network is retained, with only a slight or no shrinkage in the gel. A **‘Xerogel’** is obtained when the liquid phase of a gel is removed by evaporation.

Advantages

1. Sol–gel process produces **very pure and homogeneous nanostructures**, with relatively large quantities of final product **at low cost** at relatively low temperatures.
2. Reagents are very simple compounds.
3. Special equipment is not required (borosil/pyrex containers are used).

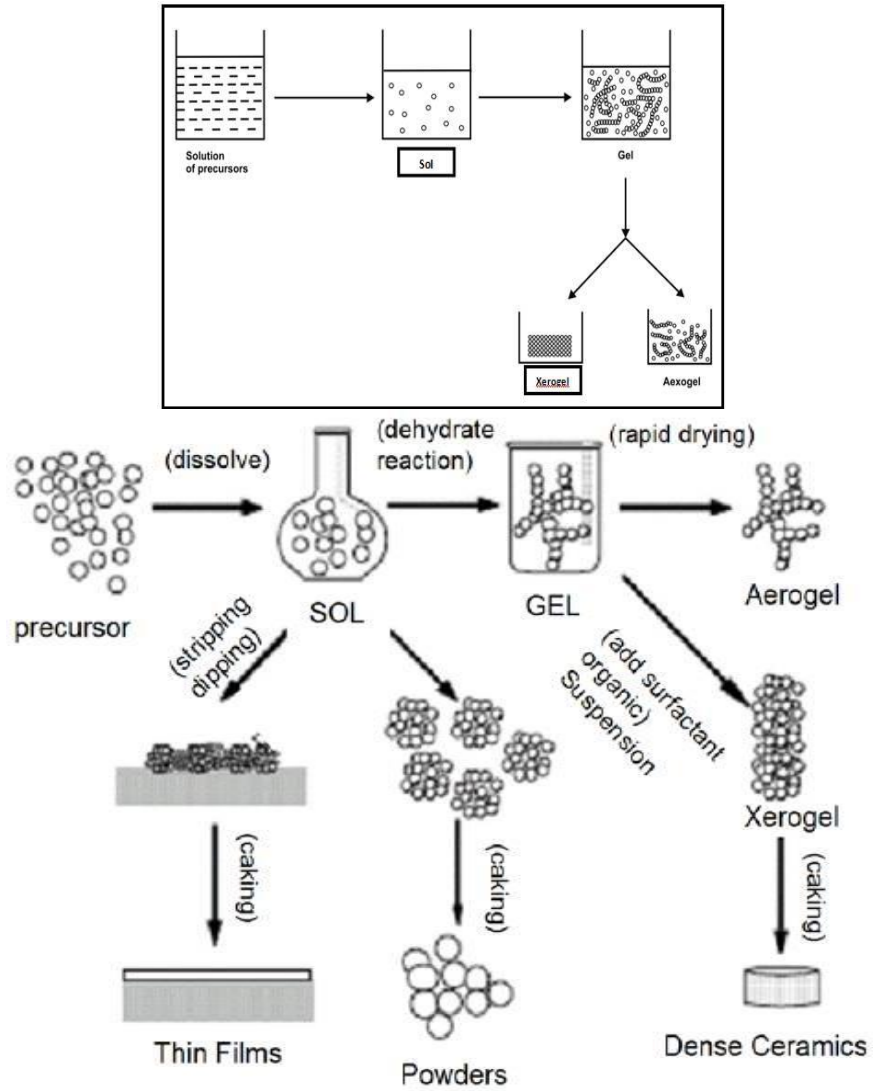


Fig.6.7: Sol-Gel process