19CH103– ENGINEERING CHEMISTRY

Unit-3 NANOCHEMISTRY

PREPARATION OF NANOMATERIALS BY WET CHEMICAL METHOD

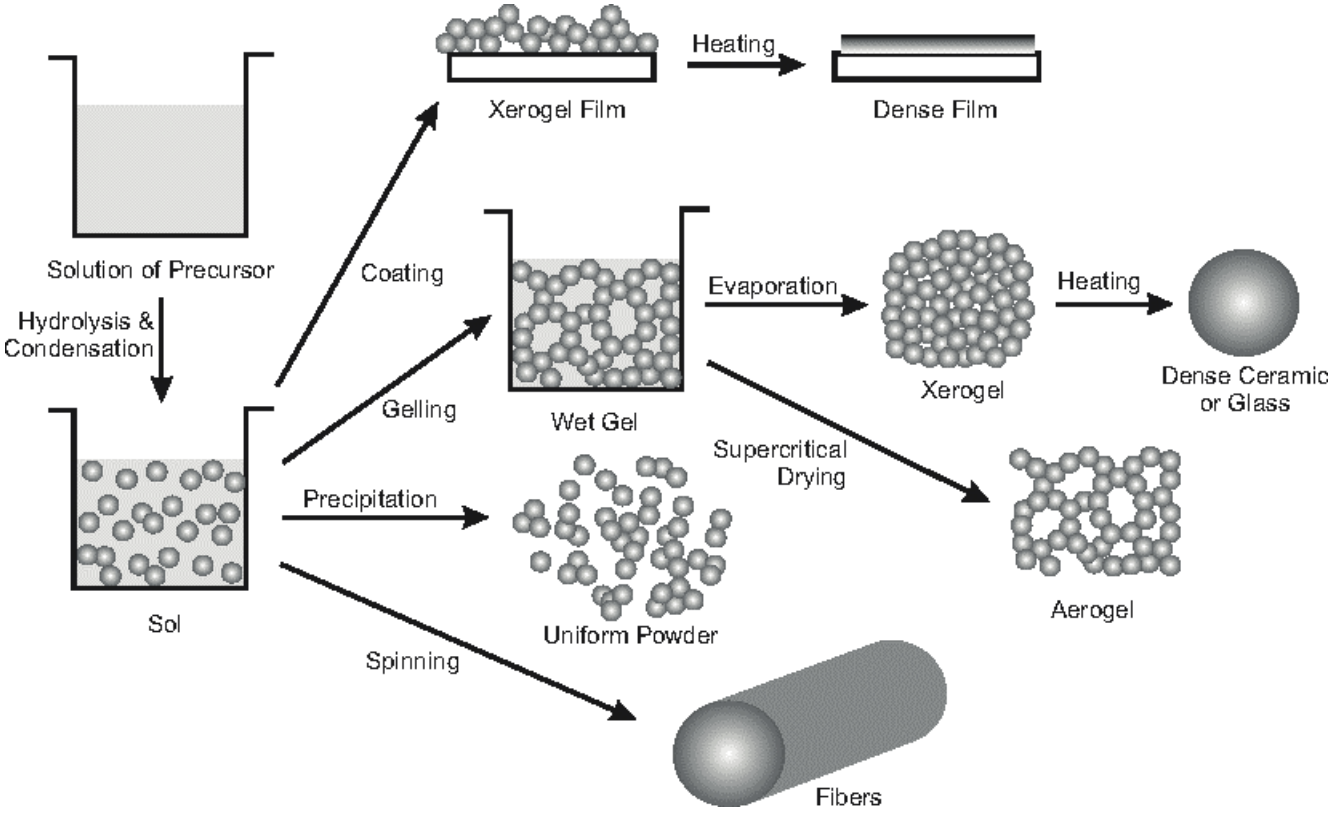
SOL-GEL PROCESS

Sol-gel process The sol-gel process, involves the evolution of inorganic networks through the formation of a colloidal suspension (sol) and gelation of the sol to form a network in a continuous liquid phase (gel). The precursors for synthesizing these colloids consist usually of a metal or metalloid element surrounded by various reactive ligands. The starting material is processed to form a dispersible oxide and forms a sol in contact with water or dilute acid. Removal of the liquid from the sol yields the gel, and the sol/gel transition controls the particle size and shape. Calcination of the gel produces the oxide. Sol-gel processing refers to the hydrolysis and condensation of alkoxide-based precursors such as Si(OEt)4. The reactions involved in the sol-gel chemistry based on the hydrolysis and condensation of metal alkoxides can be described as follows:

$$MOR + H2O \rightarrow MOH + ROH \text{ (hydrolysis)}$$

$$MOH + ROM \rightarrow M\text{-}O\text{-}M + ROH \text{ (condensation)}$$

Sol-gel method of synthesizing nanomaterials is very popular and is widely employed to prepare oxide materials.


Heating
Xerogel Film
Dense Film
Solution of Precursor
Coating
Hydrolysis &
Condensation
Evaporation
Heating
Xerogel
Dense Ceramic
or Glass
Gelling
Wet Gel
Supercritical
Drying
Precipitation
Aerogel
Sol
Uniform Powder
Spinning
Fibers