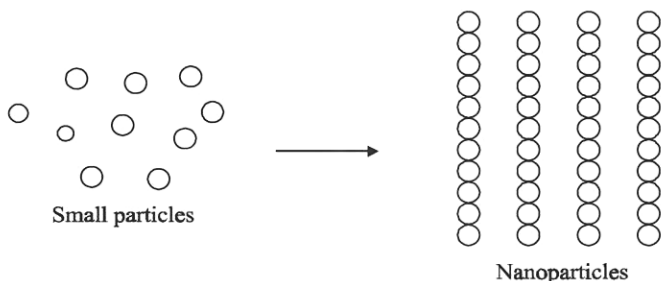




BOTTOM-UP PROCESS

- Bottom up process involves building up of materials from the bottom by atom, by atoms, molecule by molecule or cluster to the nanomaterials.



Bottom up process

(a) Solvothermal synthesis

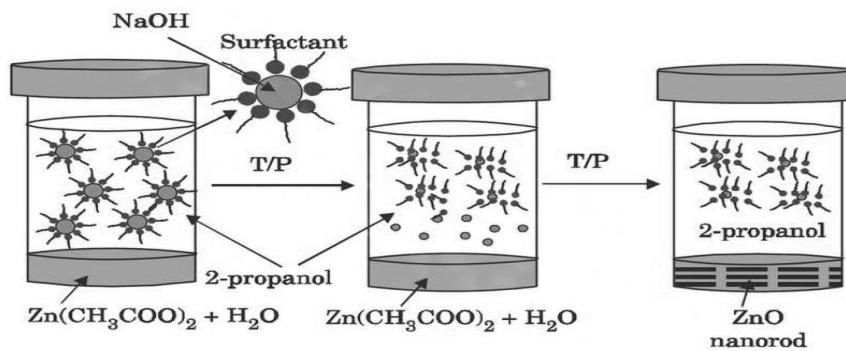
- Solvothermal synthesis involves the use of solvent under high temperature (between 100°C to 1000°C) and moderate to high pressure (1 atm to 10,000 atm) that facilitate the interaction of precursors during synthesis.

Method

- A solvent like ethanol, methanol, 2-propanol is mixed with certain metal precursors and the solution mixture is placed in an autoclave kept at relatively high temperature and pressure in an oven to carry out the crystal growth.
- The pressure generated in the vessel, due to the solvent vapour, elevates the boiling point of the solvent. **Example:** Solvothermal synthesis of zinc oxide.

Solvothermal synthesis of zinc oxide

- Zinc acetate dehydrate is dissolved in 2- propanol at 50°C.
- Subsequently, the solution is cooled to 0°C and NaOH is added to precipitate ZnO.
- The solution is then heated to 65C to allow to ZnO growth for some period of time.
- Then a capping agent (1-dodecanethiol) is injected into the suspension to arrest the growth.
- The rod shaped ZnO nano-crystal is obtained.



solvothermal synthesis