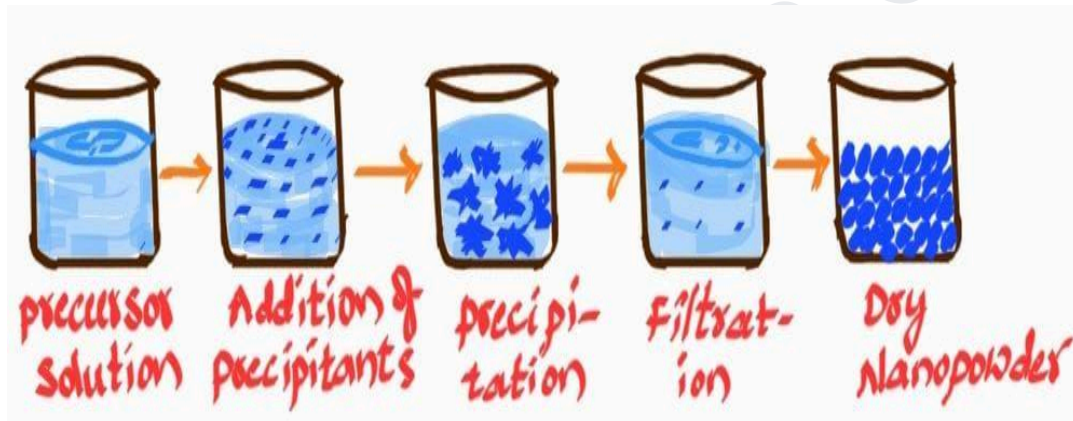


PRECIPITATION METHOD OF FABRICATION

Precipitation method of fabrication is a technique involving chemical reaction to produce solid particles such as metal oxides or hydroxides or sulphides or other inorganic nanoparticles from a solution. Precipitate is a substance that is deposited in solid form from a solution.

Principle: When two or more chemicals are mixed to react with each other, the product will settle down as precipitate.

Steps involved in precipitation method:



Preparation of precursor solutions: Prepare precursor solutions which are aqueous and contain metal salts such as chlorides, nitrates, sulphates etc.

Addition of precipitating agent: Slowly add precipitating agents such as strong bases to precursor solutions to initiate the precipitation reaction by causing the formation of insoluble metal hydroxides or other precipitates.

Precipitation - Formation of nanoparticles: When the precipitating agent (precipitant) reacts with the precursor ions, insoluble nanoparticles begin to form in the solution. The nanoparticles nucleate and grow over time as more precursor ions are converted into solid particles (nanoparticles).

Filtration: The solid particle suspension is separated from the reaction mixture by centrifugation or filtration. These collected particles are **washed** several times with solvent to **separate** residual reactants, impurities or by-products.

Drying & Annealing is an optional process: The washed nanoparticles may be dried at low temperatures and achieve a dry powder form. Annealing (or) calcination may be performed to improve crystallinity.

NOTE: Control reaction parameters/conditions: control the reaction time, pH, conc., temperature to achieve the desired particle size & crystalline structure.

Advantages:

1. It is a simple, low cost and rapid method for precipitation of nanoparticles.
2. Low reaction temperature & control of particle size.
3. Fine and uniform sized particles are products.
4. Time and energy efficiency.

Disadvantages:

1. Difficult to control the size and shape of the Nanomaterials.

Applications:

1. synthesizing nanoparticles, nanorods, thin films, and monoliths.
2. This technique allows for the creation of hybrid nanoparticles in various industries.
3. It's also a valuable method for synthesizing catalysts, like Ni-Nb-O mixed oxides.