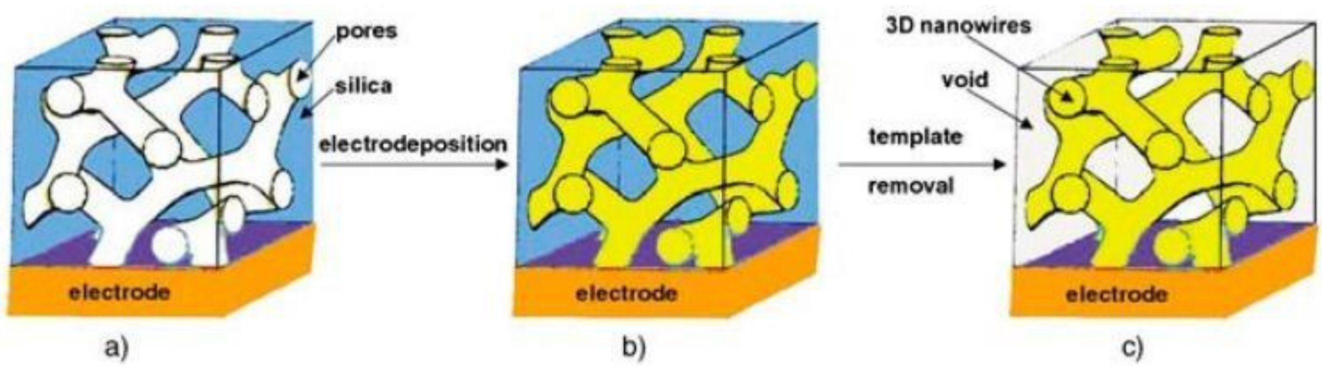
19CH101– ENGINEERING CHEMISTRY

Unit-3 NANOCHEMISTRY

ELECTRO CHEMICAL DEPOSITION

Electrochemical deposition is an efficient procedure to prepare metal nanoparticles but it is usually less utilized than wet-chemical methods. This approach can sometimes display some limitations as to the nanomaterial dimensions and the allowed morphologies, but it shows a lot of advantages, particularly related to the rapid synthesis time, the absence of chemical reductants or oxidants, and of undesired by-products . Furthermore, when the modifier film is directly deposited on the electrode it permits a better adhesion to be obtained . Electrodeposition is widely applied using different electrochemical techniques, such as cyclic voltammetry, potential step and double-pulse deposition . The possibility of a precise particle size control is achieved by adjusting current density or applied potential and electrolysis time . Furthermore, combined with a template, electrochemical synthesis gives the opportunity to produce a variety of 3D networks, e.g., through mesoporous silica films (this is the case of noble metal nanowires.



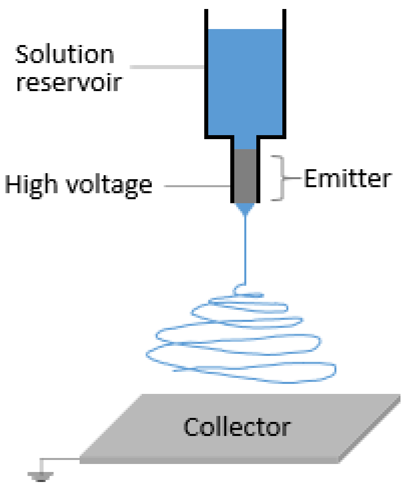
(**A**) 3D cubic mesoporous template, (**B**) 3D nanowire/silica nanocomposites, (**C**) 3D nanowire network. Images reproduced from Ref. [8] with permission

With the introduction of colloidal silica, more complex nanostructures, such as sponge-like and grass-like morphologies, can be synthesized by varying the dimension and shape of the silica additives [9].

This review aims to describe the most recent applications as electrochemical sensors of supports modified with electrodeposited nanomaterials or obtained by electrosynthesis, belonging to two categories: inorganics and organics. In the former case metals, layered double hydroxides (LDHs) and metal oxides (and hybrids) have been taken into account, in the latter conducting, insulating and molecularly imprinted polymers (MIPs) have been considered.

ELECTRO SPINNING

Electrospinning is a voltage-driven process governed by the electrohydrodynamic phenomena where fibers and particles are made from a polymer solution. The most basic set up for this technique involves a solution contained in a reservoir (typically a syringe) and tipped with a blunt needle (for needle-based electrospraying), a pump, a high voltage power source and a collector.



The spinning process starts when the solution is pumped at a constant flow rate and a specific voltage is applied to create an electric field between the needle tip and the collector. A charge accumulates at the liquid surface. When the electrostatic repulsion is higher than the surface tension the liquid meniscus is deformed into a conically shaped structure known as the Taylor cone.

Once the Taylor cone is formed, the charged liquid jet is ejected towards the collector. Collectors can be but are not limited to, stationary flat plates, rotating drums, mandrels, and disks. Depending on the solution viscosity solid fibers will be formed as the solvent evaporates from the whipping motion that occurs during its flight time from the Taylor cone to the collector. The result is a non-woven fiber mat that is deposited on the collector.