REVIEW ON NANOMATERIALS: SYNTHESIS ,TYPES AND APPLICATIONS

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Abstract: The new history of technological growth has shown that the main element is evolution in nanotechnology and nanoscience. Nanotechnology is a multidisciplinary science that deals with the sciences of physics , chemistry, materials and other engineering. In almost all fields of science and technology, the applications of nanotechnology are spreading. The present review paper illustrated the kinds of nanoparticles and their methods of synthesis as well as techniques of characterization. This review summarizes the background of nanotechnology , nanomaterials , nanocomposites and their applications in precious lives of human beings.
Key word : nanoparticles , nanocomposite, nanotechnology

I. INTRODUCTION

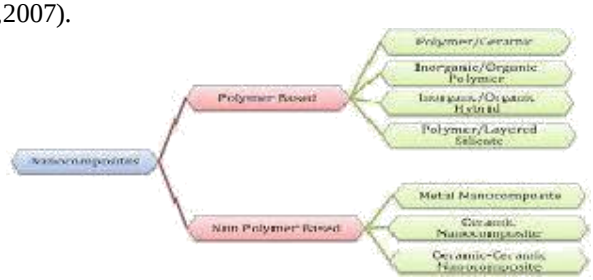
Nanotechnology is crucial present analysis in current era. Nano- scale materials hold normally the scale smaller than 100nm.Today individuals demand limited and sturdy supplies so nanotechnology has pure ambition to provide microscopic supplies with a number of distinctive properties and undesirable waste as attainable (Luther *et al*., 2009). Nanotechnology is fundamentally investigation of minuscule structures. It is gotten from Greek word nano that implies overshadow or dwarf. The Nano implies little size. Nanotechnology includes top down that is lessening the size of bigger structures and base up technique that is changing the individual iotas or atoms in to nanostructures (Nikalje et al., 2015).The nanomaterials has wide applications in biomedical fields, mechanical fields,electronics,ceramics and motor transmissions oil and so forth. They are utilized in sunscreens, sport things, materials and beauty care products and so forth. Also the nanotechnogy can possibly improve the ways of life particularly of the individuals who are experiencing extreme heath issues (Jiang et al.,2009).The metal oxide and carbon nanocomposites are utilized for applications in natural insurance and natural union of synthetic concoctions in view of higher surface zone, high versatility, higher electron conductivity and high substance stability(Saranya et al., 2014).The substantial metal particles, natural contaminants that are contained in squander water released during electrolysis, electroplating, pesticides, medication, paint, paper making, printing, coloring and materials from the various businesses as a rule making hurt biological environment(Dong et al., 2018). Nanocomposite is utilized as an impetus for the expulsion of poisonous contaminations and is utilized for the debasement of natural colors (Jia et al., 2018). The cleaning of hurtful contaminations from wastewater is necessary for the assurance of wellbeing and condition so extraordinary orchestrated nano-materials utilized as amicable adsorbents for the evacuation of different unsafe contaminants, for example, substantial metal particles (Cu, Pb, Hg, Ni, Zn, Cd and so forth) and colors (methyl orange) present in wastewater (Dave et al., 2014).The nanocomposite particles or nanomaterials can be delivered by various strategies for example aqueous, co-precipitation and sol-gel technique. The blend method is utilized based on prerequisite of wanted material and the offices accessible (Srivastava, 2012).

1.2 Nanotechnology

Nanotechnology is a field of applied science and innovation that manages the immediate control of issue at nuclear, sub-atomic and supramolecular level. This level reaches from 1 to 100 nanometer and is called nanoscale (Ferrari et al., 2005).Nano word began structure Greek word "nanos" signifies predominate. Term nanotechnology was begat by Professor Norio Taniguchi decade after the eminent physicist Richard Feynman gave the thought and idea about nanoscience by giving a talk with title "There is Plenty of Room at the Bottom" in December 1959.

1.3 Nanomaterials

In Nanoscience and nanotechnology, tiny things are read for their outstanding physio- synthetic attributes and their applications in numerous fields of sciences including surface science, inorganic and natural science, semiconductor physical science, material sciences, sub-atomic science, vitality stockpiling, sub-atomic designing and microfabrication. Nanotechnology has presently become elating forefront field in expository science. Assortment of nanomaterials, transcendently nanoparticles and nanocomposites with disparate qualities are being utilized widely in various sorts of expository investigation. by virtue of their nano size, nanomaterials having particular physiochemical and electrochemical qualities are being used in wide scope of uses particularly nanomedicine (Buzea *et al*.,2007).



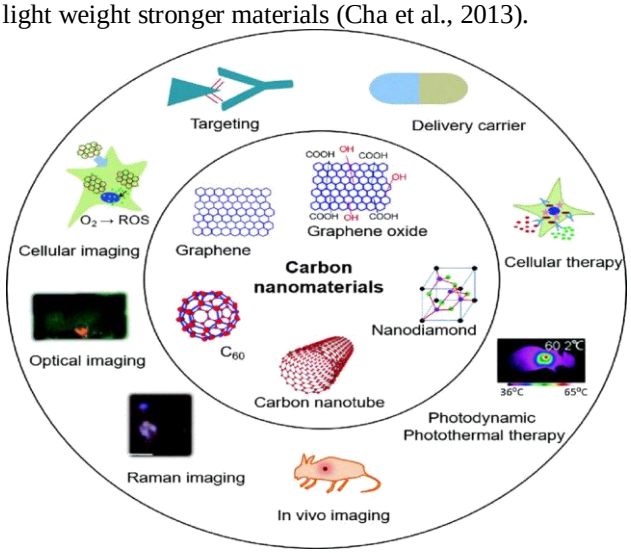
1.3.1 Classification of nanomaterials

Nanomaterials are classified into four main types

- Carbon based nanomaterials
- Metal based nanomaterials
- Dendrimers
- Nanocomposites (Stone et al., 2010).

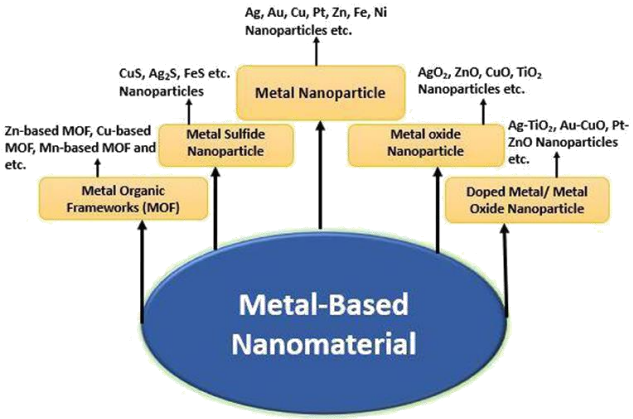
1.3.2 Carbon based nanomaterials

Carbon based nanomaterials are predominantly made up of carbon such tubes, hollow spheres and ellipsoids. Carbon based nanomaterials in spherical and ellipsoidal form is termed as fullerenes. On the other hand, nanomaterials exist in the form of cylindrical shape is termed as carbon nanotubes. Graphene is an excellent example of carbon-based nanomaterials. These carbon-based nanomaterials are potentially used in variety of applications like electronics, developing strengthened films and coatings, and synthesizing light weight stronger materials (Cha et al., 2013).



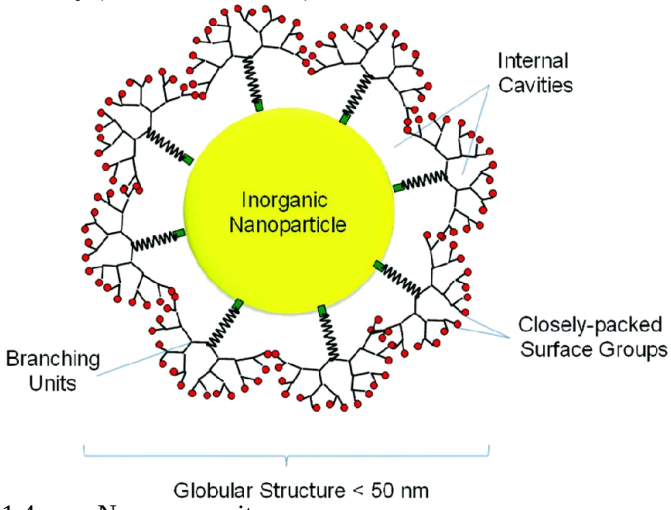
1.3.3 Metal based nanomaterials

Metal oxides nanomaterials, Quantum dots, nanowires, nanorods, nanogold and nano silver are few examples of metal-based nanomaterials having excellent optical and electrical characteristics are being extensively used as nano catalysts, biosensors, in optoelectronic devices like OLEDs and organic solar cells, tissue engineering and drug delivery (Dreizin et al., 2009).



1.3.4 Dendrimers

Dendrimers are nanomaterials with extremely symmetric molecules with definite, homogeneous and monodisperse structure in the form of highly branched or star shaped macromolecules. These are polymers made up of branched units. Chain ends of these polymers can be engineered to serve certain chemical functions like catalysis and drug delivery (Barrett et al., 2009).



1.4 Nanocomposites

Nanocomposites are multiphase nanomaterials having at least one phase in nano dimension. Nanocomposites are synthesized by incorporating nanoparticles with other NPs or bulk matrix material. The resulting nanomaterials have enhanced physiochemical, mechanical, electrical, magnetic optical, catalytic and electrochemical characteristics.

1.5 Synthesis approaches of nanomaterials

Nano-Technology innovations and flow progression in research have perceived different combination strategies for the nanoparticles with changed materials run including earthenware production, metals, polymers, metals and semiconductors. Nanoparticles contain novel basic, morphological and physiochemical properties relying upon the inception and strategies for union. These properties are significant for controlled and great quality nanoparticles with wide scope of utilizations identified with optical, condition, electronic, biomedical and optoelectronic territories. For the arrangement of nanoparticles two primary methodologies are utilized, for example, top-down strategy and base up technique. In view of the states of response, embraced conventions and tasks these methodologies partitioned into various subclasses. (Dhand et al., 2015).

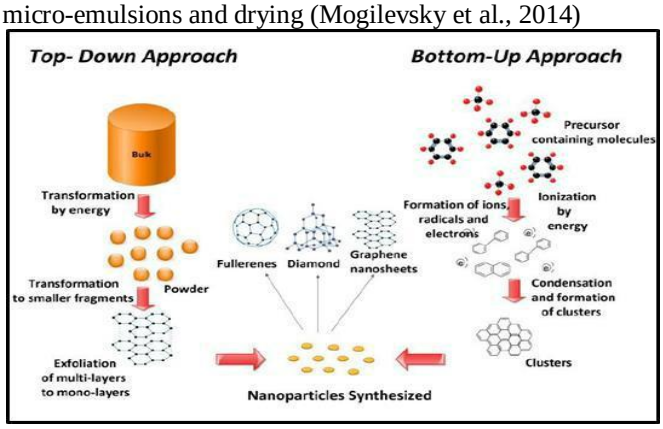
1.5.1 Top-down synthesis

Harmful technique is used for this technique. On this synthesis approach bigger molecules are employed as beginning materials and adjusted into limited items afterwards decomposition.These microscopic unit afterwards reworked into acceptable nanoparticles. Milling process, plasma and ion etching, lithography of electron beam, anodization and photolithography are the usually utilized strategies of top-down for the nanoparticles mass manufacturing (Belo et al., 2015).

1.5.2 Bottom-up synthesis

On this technique nanoparticles are produced from

microscopic particles of liquid or gas depends upon atomic vary and molecular condensation. This synthesis method contains the atoms and molecules meeting and union to produces the various vary of nanoparticles. This methodology examples contain the sol-gel process, plasma or flame spraying method, nanostructured electrochemical precipitation, laser pyrolysis, bio-assisted approach and chemical deposition, microwave and extremely sound irradiation, hydrothermal process, co-precipitation, freeze, micro-emulsions and drying (Mogilevsky et al., 2014)



1.6 Importance of nanocomposites

Nanocomposites are diverse structure mass composite materials because of their incredibly high surface to volume proportion of support stage. They have improved optical, electrical, heat obstruction and mechanical properties. Nanocomposites are being utilized in various fields like aviation, car, hardware, material, structural designing, bundling, biotechnology, biomedicines, photocatalysis, biosensors and electrochemical sensors (Mittal et al., 2011).

1.7 Nanoparticles

Nanoparticles having the molecule size of 1to 100 nanometers. They have enormous surface area and lower particle size. The surface region and proportion of volume builds the effectiveness of catalysis. It likewise expands the opportunity of blending in with different materials and utilized as nanocomposites (Philips and Shima, 2012).The nanoparticles are not considered among the other four states of matter for example solid, liquid, gaseous and plasma since they have particular qualities like higher surface territory, so nanoparticles are considered as an extraordinary condition of issue. Nanotechnology is a procedure that is utilized for the blend, planning and use of materials and gadgets, whose shapes and size is made at nanoscale. There is a way of thinking that accepts that nanoparticles are in a general sense new. They additionally state that mass materials and traditional synthetic substances can't be contrasted and nanoparticles(Nowack et al., 2011).

1.7.1 Classification of Nanoparticles

Nanoparticles are classified as;

a. Zero-Dimensional Nano-materials

The zero dimensional nanomaterials have all dimensions of nanoscale range. The example of zero dimensional nano-material is nanoparticle. The nanoparticle can be amorphous, crystalline, ceramic, polymeric or metallic (Khan et al., 2016).

b. One-Dimensional Nano-materials

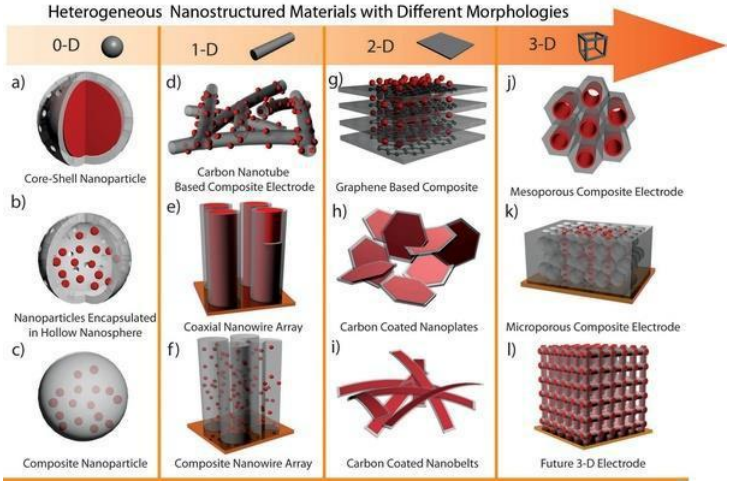
The materials containing one dimension in nanoscale are thin films or manufactured surfaces. A thin film is also called as a monolayer. It is used in biological and chemical sensors, magnetic and fiber optic systems and informative storage systems.

c. Two-Dimensional Nano-materials

The two dimension materials in nanoscale are called as two dimensional nanomaterials. The example of 2D nanomaterials is carbon nanotubes.

d. Three-Dimensional Nano-materials

The materials in all the three dimensions called as 3-D nanomaterials. The 3-D nanomaterials includes: Fullerenes (carbon 60) and quantum dots (Bhatia, 2016; Buzea et al., 2007).



1.7.2 Synthesis of Nanoparticles

The nanoparticles are synthesized using different methods. Some of the methods are described below;

a. Co-precipitation Method

This method is used for the synthesis of nanomaterials with narrow size distribution and this method does not require costly equipment and complex procedures (Wang et al., 2011). It is used for the preparation of nanoparticles of metal oxides, mixed metal or metal ceramics nano-composites and produces a precipitates that are separated from the solution (Lateef & Nazir, 2017).

b. Sol-Gel method

It's used for the synthesis of metal oxide nanoparticles in materials chemistry. It includes hydrolysis, condensation and drying. Step one on this technique includes the hydrolysis of a precursors to figure a sol i.e.; colloidal solution which is the then adopted by condensation to appearance a gel (Rao et al., 2017). This method is often used for synthesis of nano-particles as in comparison with different methods as a result of it's simple, power conserving and entails single step (Hemalatha et al., 2016).

c. Hydrothermal or solvothermal method

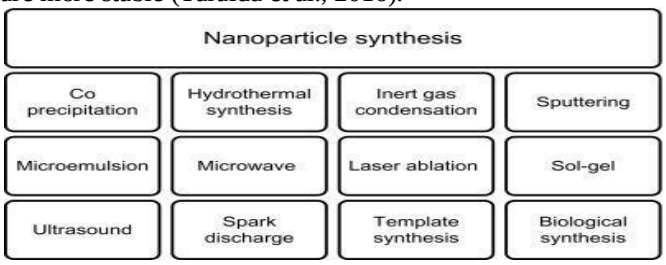
hydrothermal method is a proficient method used to create nanomaterials with assortment of morphologies. The reactants are kept in autoclave that is stacked with water or organic compound. This strategy happens at higher temperature and higher weight. On the off chance if non aqueous dissolvable is utilized as a mechanism for the response than it is named as solvothermal and on the off chance that precipitation happens within the sight of watery dissolvable, at that point it is named as hydrothermal method (Rao et al., 2017).The antecedents utilized in this technique are reactants in type of arrangement, gels or suspensions. Inorganic or organic added substances with high concentrations are utilized as mineralizers to control the Ph of arrangement and added substances utilized at low fixation are utilized to control crystal morphology (Li et al., 2016).

d. Microwave Assisted Synthesis

Microwave Assisted Synthesis is the method that includes the warming of material by microwave irradiations and this procedure relies upon the capacity of a solvent or a reagent material to retain microwave energy. This procedure includes less time and warming with microwave the vitality can applied legitimately to the example. The microwave-Assisted union is called as green technique since it doesn't creates any poisonous materials, for example, exhaust of gas and so forth (Rina et al., 2012)

e. Biosynthesis method

Bio-synthesis method is a cost effective technique used for the synthesis of nanoparticles. This method includes microbes for the synthesis of nanoparticles of metal oxides. The biosynthesis technique used for nanoparticle synthesis can be intracellular or extracellular depending upon the location of nanoparticles (Hassan, 2015). Reduction or oxidation is considered as the main reaction for the preparation of nanoparticles via biosynthesis method. This technique involves the microorganisms to grow in salt solution to observe their compatibility and an organism that grows are kept for fungal ball preparation. This further releases enzymes for the breakdown of salts in to the nano-form. The nanoparticles synthesized by using this technique are more stable (Tarafda et al., 2016).



1.8 Metal oxide nanoparticles

The significant nanomaterials incorporate basic metal oxides, for example, oxides of zinc, copper, cerium, iron, silicon and aluminum. These nano-sized of various oxides of components have various properties and the utilizations of these oxides essentially rely on the inside properties of component in mass state. The nanosize particles of silicon oxides have applications in earthenware production and glass businesses. The iron oxide particles of nanosize have application in attractive materials. The oxides of cerium, titanium, aluminum, zinc and copper in nanosize have applications in heat move (Hung et al., 2008).The nanomaterials comprise of metal oxide semiconductors that have immense applications in a few territories of exploration for example biosensors, catalysis and optoelectronics etc.The zinc oxide present as mineral zincite in earth outside layer is broadly utilized as added substance in various items, for example, elastic, paint, earthenware production and shades (Hussain et al., 2014). Nanoparticles of metal oxide have various applications in the field of innovation for example they are use as thermo-electrical material, electroluminescent or semi conveyor. They are utilized as ecological sterilization in bio-medicine applications and analysis as medication conveyance framework. (Seabra &Duran, 2015).

1.8.1 Cerium oxide nanoparticle:

Cerium is called as the rare earth metal and it exists in both trivalent (Ce3+) and tetravalent states (Ce4+).Cerium oxide have incredible applications in sunlight based cells, gas and bio sensors because of its unmistakable attributes like non harmful, bio-similarity, capacity of oxygen stockpiling, optical and warm properties (Mohanapriya et al., 2016). Nanoparticles of cerium oxide are generally utilized in sun oriented cells, fumes car treatment, as fuel oxidation catalysis, cleaning and erosion security. The various strategies are utilized for cerium oxide nanoparticles blend contingent on its size and morphology (Dhall et al., 2018). The amalgamation of cerium oxide nanoparticles has expanded the enthusiasm of specialists in light of its unmistakable properties in material science and innovation. Cerium oxide is utilized as cleaning specialists, energy components, sun screens, and photograph impetus and sensor applications. Various strategies, for example, co-precipitation, sol gel and aqueous strategy are utilized for the union of cerium oxide nanoparticles relying on its morphology (Khadar et al., 2018). The union of cerium oxide based nanoparticles have expanded the enthusiasm for late time because of its wide applications in various regions, for example, in microelectronics optoelectronics, gas sensors, optoelectronics, strong state electrolytes, energy unit advancements and photocatalysis .

1.8.2 Cerium dioxide (CeO2)

Cerium (Ce) is tender and ductile silvery white uncommon globe steel belongs to lanthanide series. Cerium being electropositive in nature exists in each 3+ and 4+ oxidation states as CeO2 and Ce2O3. CeO2 is extra secure than Ce2O3. Pure ceria has band gap of 5eV. However, in cerium oxide NPs it has mix oxidation states at its surface. Cerium dioxide (CeO2, ceria) is technologically versatile nanomaterial having obese numbers of potential purposes in catalysis, glass polishing, planarization, corrosion protection, photo voltaic cells, automotive exhaust catalyst, oxygen sensors, gas cells, electrochromic skinny films, biotechnology, nanomedicines, photochemistry and in electroanalytical chemistry electrode materials for electrochemical sensing gadgets .

Table 1.1 Physical and Chemical properties of cerium dioxide

Molecular formula	CeO_2
Molar mass	172.115 g/mol
Appearance	white or pale yellow solid, slightly hygroscopic
Density	7.65 g/cm^3, solid 7.215 g/cm^3, fluorite phase
Melting point	2400 °C
Boiling point	3500 °C
Solubility in water	Insoluble

1.8.3 Cerium oxide nanoparticles

Cerium oxide NPs have magnificent physiochemical properties and is being utilized in LPG sensors and as electrolyte material in strong power devices. As of late, it has likewise been utilized as Cr (VI) permeable present in wastewater. Ceria NPs have enormous number of oxygen opportunities because of its huge surface to volume proportion. Thus, cerium oxide NPs show incredibly novel physiochemical properties. Their electrical conductivity is upgraded at nanoscale .

1.9 Nanocomposite

The composite material where one of the constituent has the size of nanoscale that is 10-9 nanometer is characterize as nanocomposite. Array of 2 materials having disparate stages, physical and chemical properties isolated by particular line is characterized as composite material. The nanocomposite is comprised of a composite and the support comprising of strands. The segment present in huge sum is considered matrix and the part that is implanted in the matrix is called nanomaterials. The framework work is to ensure the filaments (Pandya et al., 2013).Nanocomposites have better adsorption limit, selectivity and soundness. Nanocomposites can be utilized as adsorbents, photocatalyst and sensors to handle contamination issues Nanoparticles have a higher surface area when contrasted with mass materials so they are alluring to use as an impetus. Impetuses quicken a huge number of substance responses and along these lines structure the premise of synthetic industry. A significant number of the nanocatalyst discovered different applications, for example, in smelling salts union, fiber, ecological security, photocatalyst, squander expulsion and debasement of colors and so on .

1.10 Classification of Nanocomposite materials

Nanocomposite materials are classified in to three classes given below;

a. Metal Matrix Nanocomposites (MMNC)

It includes materials of ductile metals or alloy matrix in which nano-size material is inserted. Metal and ceramic features combined with these nanosize materials due to being ductile. Metal matrix nanocomposites are acceptable for the manufacturing of materials with soaring strength, high modulus and elevated service temperature capabilities. MMNC own large makes use of in varied areas equivalent to aerospace and automotive industries and improvement of structural materials .

b. Ceramic Matrix Nanocomposites

This consists of ceramic fibers which can be embedded in a ceramic matrix .The ceramic matrix nanocomposites these days are utilized in the sphere that require reliability at hot temperature (above the potential of metals) and resistance to corrosion. This consists of warmth protect entity of house vehicles, parts for burners, flame holders and for manufacturing the elements of hot temperature gas turbines. This matrix is costly and lengthy lasting .

c. Polymer Matrix Nanocomposites

Polymer is utilized as a framework and non additives are utilized as fortified material in polymer lattice nanocomposites. The non added substances incorporate one, a few dimensional nanoparticles. It has extraordinary attributes, for example, higher quality, flexible solidness having a lower grouping of nanoadditives, fire retardancy, hindrance opposition, and wear obstruction, attractive, electrical and optical properties .

1.10.1 Cerium-zinc nanocomposites

Heterostructure ZnO-CeO2 nanocomposite has transitional estimations of UV absorption just as obvious light straightforwardness. The band hole of ZnO is to some degree more noteworthy than that of CeO2 however a decrease in the band hole was watched for the heterostructure nanocomposite. The decrease in the band hole is an aftereffect of an expansion in oxygen opportunities in the framework upon the substitution of Zn2+ by Ce4+ .

CeO2 and ZnO are significant semiconducting metal oxides, because of their significance in different fields they separately achieve a lot of consideration. Firmly stuffed NPs in paired metal oxides frameworks have solid surface connections. In these frameworks, CeO2 and ZnO composite are acceptable materials which shows great properties to utilizes as impetus than singular oxides .In modern waste water for the natural toxins' evacuation CeO2-ZnO nanocomposites are utilized. Efficient route provides in solution phase synthetic method for CeO2-ZnO for CeO2-ZnO nanocomposites which increment the ZnO nanostructures field outflow capacity and associated with various potential applications like these are utilized as optoelectronic gadgets, photocatalysts and as substance sensors .

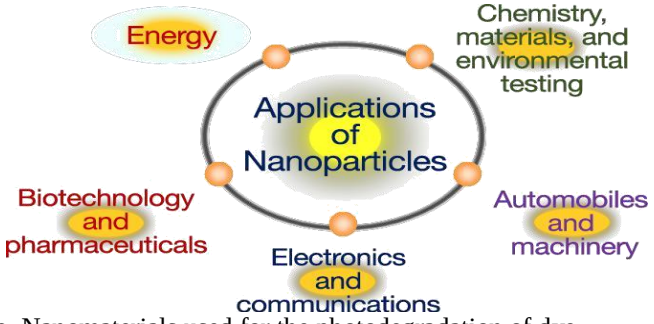
1.10.2 Cerium cobalt nanocomposite

The metal oxide catalysts have increased the interest for the degradation of chlorinated aromatic compounds due to their lower cost, higher catalytic activity, higher thermal stability, and the synthesis of high-surface-area materials without any difficulty. A Ce-Co composite was used as a catalyst for the environmental protection. The cerium cobalt oxide nanocomposite shows a excellent catalytic properties for the degradation of 1, 2, 4-trichlorobenzene due to higher surface area .The resulting nanocomposite produced from the combination of cerium and cobalt such as cerium oxide as a phase and cobalt as metal matrix give some unique properties such as used as biomaterials or wear corrosion resistance coating .

1.11 Applications of Nanomaterials

Nanomaterials as waste water treatment

The waste water delivered from various sources, for example, local locations, modern, agribusiness and so on and whenever left untreated it might make hurt living creatures and condition. Nanotechnology is utilized for the treatment of waste water because of its minimal effort, can be reuse and is exceptionally effective in eliminating the toxins from squander water (Tyagi et al., 2012).Nanomaterials having little size, huge surface region; high adsorption limit and reactivity make it productive to manage the debased waste water. The nanomaterials utilized for squander water treatment incorporate metal oxides, nanoparticles, nanocomposite and carbon nanotubes (Lu et al., 2016). The different nanomaterials were combined for squander water treatment and these nanoparticle utilized as photocatalyst for the treatment of harmful poisons (Anjum et al., 2016). Expulsion of poisonous materials from wastewater is essential for wellbeing and natural security, so different nanomaterials are incorporated and utilized as powerful, ease and eco cordial adsorbents for the purification of various unsafe toxins from wastewater like weighty metal particles (Cu, Pb, Hg, Ni, Zn, Cd and so forth) and colors (methyl orange) and so on as exploration represented by Dave et al. (2014) orchestrated iron oxide nanomaterials and utilized as the adsorbent for the expulsion of weighty metal particles from fluid frameworks.



b. Nanomaterials used for the photodegradation of dye

The presence of dyes in water isn't great since even little centralizations of these colors are harmful to amphibian or aquatic conditions. Wastewater-containing dyes are exceptionally hard to treat so minimal effort adsorbent materials have been orchestrated and read for their capacity to eliminate dyes from the waste water. PANI–NiFe2O4 nanocomposite was blended in situ through self-polymerization of monomer aniline to eliminate methylene blue color from fluid arrangement (Patil et al., 2016). It was shown that the Ag3PO4/MoS2 composite is dynamic photocatalyst utilized for photodegradation of color. The Ag3PO4/MoS2 composite impetus shows improved photocatalytic movement for color debasement when contrasted with the Ag3PO4 nanoparticles under noticeable light illumination (Sharma et al., 2017). The orchestrated MgO/TiO2 metal oxide nano-composite show noteworthy potential to degrade azo color (Methyl red) under UV-noticeable light illumination.

c. Nitrophenols converted in to Aminophenols

Nitro compound is a class of dangerous pollutants that is causing harm to environment. The 4-Nitrophenol which is harmful chemical compound produced in the environment from dyes, industries and agriculture. This is harmful for human health so the nanomaterials are used as nanocatalyst for the conversion of 4-Nitrophenols in to 4-Aminophenols .

d. Nanomaterials as sensors

Nanostructures and nanomaterials are utilized to expand the selectivity and affectability of the nano based detecting gadgets. Test arrangement improvement, upgrade in adaptability and new identification procedures configuration are likewise due to nanomaterials. It is confirmed that diagnostic instruments discovery framework improved by the utilization of nanostructures and nanomaterials (Bulbul et al., 2015). Sensor is a module or gadget which normally electronically recognizes or measure variable amount, and changes over them into sign to be recorded. Examination of sensors dependent on selectivity, strength, and affectability. Sensors classification depends on the kinds of vitality transmission as mechanical, electromagnetic, electrochemical just as warm. Electrochemical sensors are significant logical techniques because of high selectivity and affectability. By and by more centered around creating nanomaterials. These are utilized in electrochemical sensors for signal intensification. Electrochemical sensors are utilized in clinical, natural examination, building, clinical symptomatic, ecological investigation and word related security .A significant pretended by the sensors in the region of halting the ecological barometrical testing, recognition of harmful gases, noxious modern creation and fire blast episode.

e. Nanoparticle Applications in Medicine

In present days there is an incredible need of simple, minimal effort, quick and solid identification procedures for the different natural infections conclusion and monitoring. The extraordinary interest in the current century is the more delicate synthetic and organic sensors to defeat the building, instructive and logical issues. Logical location identified with the arrangement of nucleic corrosive, cell receptors, proteins, compound and organelles. These examination helps the medical services experts and biomedical specialists to know the about the microorganisms and illnesses and addition complete information about ailments and state of the patient. Presently days different test traditional modes utilized are delayed in cycle and test materials required in extraordinary sums. For the recognition or different sorts of biomaterials these strategies are extremely reliable, ease, and quick for location multiplexed screening structure. Nanoparticles of little size are significant in medication since they can without much of a stretch circle in the body and enters in the cell. These properties of the nanoparticles gives the better approaches to the tumors, tissues sickness and organ related illnesses pictures .

f. Nanotechnology and electrochemical procedures

The combination of nanotechnology with present day electrochemical procedures permits the presentation of incredible, dependable electrical gadgets for powerful cycle

and contamination control. In spite of the fact that the NPs when all is said in done assume various parts in various electrochemical sensors, with respect to electroanalysis utilizing a NP-altered anode has a few favorable circumstances:

- Effective catalysis
- Fast mass transport
- Large effective sensor surface area
- Good control over electrode microenvironment

Electrochemical sensors have been employed for several decades for a variety of environmental monitoring applications, including monitoring of water-quality parameters (conductivity, dissolved oxygen or pH), measurement of trace heavy metals and carcinogens and organic pollutants (N-nitroso compounds, aromatic amines and phenols).

g. Role of nanotechnology in electrochemical sensors

Electrochemical sensors are easy to understand, require basic method, reagent-less, ease, very quick, on-line observing and so forth. As there is a lot of room for development in electrochemical sensors required regarding selectivity and affectability. Supposedly there are not many nanocomposites based electrochemical sensors particularly Ceria and ZnO based nanocomposites being utilized as electrochemical sensors. Besides, no similar investigations of the physio concoction qualities are completed for the said nanocomposite procured by various manufactured strategies.

II. CONCLUSION

Nanotechnology is an emerging area of science that involves the engineering of nanosize particles of various materials. The research and development of nanotechnology is very active globally, and nanotechnologies are already used in hundreds of products, including sunscreens, cosmetics, textiles, and sports equipment. Nanotechnology is also being developed for use in drug delivery, biosensors, and other biomedical applications.

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