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SELECTION AND CREATION OF NANO PARTICLES USING ARTIFICIAL INTELLIGENCE

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Abstract

The chemical characteristics of nanoparticles is important for innovative composition. Secondary ion mass spectrometry is a powerful technique to measure the chemical composition of nanoparticles with depth by measuring the particles that are ejected from the surface by an incident primary ion beam in a process known as 'sputtering'. due to both the dimension of nanoparticles being comparable to the size of the primary ion collision cascade, and the larger available surface area for secondary emission, the sputtering yield is expected to be significantly different for nanoparticles compared to bulk materials.the nano particles vary in size and in their chemical composition.

Key words Nano particles,shapes,artificial intelligence,kbs

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1.INTRODUCTION

Nano is a greek word that has emerged from the greek word extremely small in sizeNano science and technology is the modern world concept which is based on the **science of tiny particle within the size range from 1 to 100 nanometers**. A nanometer is very small its 10 -9 m. Nano technology is the study of manipulating matter on an atomic and molecular scale.the nano particles are created using different chemical composition. Their composition are taken using artificial intelligence techniques. We must provide the knowledge of classification of materials and evaluated according to the following.

Evaluation of Nano particles

1.particle size

2.density

3.molecular weight

4.structure and crystallinity

5.specific surface area

6.surface

The nano particles must be selected according to the above evalution and stored in a knowledge base. then it is retrieved and new nano particles are created.the knowledge base contain all the information about the chemical/material structure,surface area,molecular weight etc.these are stored in the knowledge base.whenever the user need to create a new nano particles these knowledge base will assist to find their features and composition etc.

2. Types and classification of nanomaterials

Most current NPs and NSMs are organised into four categories.

(i) **Carbon-based nanomaterials**: Generally, these NMs contain carbon, and are found in morphologies such as hollow tubes, ellipsoids or spheres. Fullerenes (C60), carbon nanotubes (CNTs), carbon nanofibers, carbon black, graphene (Gr), and carbon onions are included under the carbon-based NMs category. Laser ablation, arc discharge, and chemical vapor deposition (CVD) are the important production methods for these carbon-based materials fabrication .

(ii**) Inorganic-based nanomaterials**: These NMs include metal and metal oxide NPs and NSMs. These NMs can be synthesized into metals such as Au or Ag NPs, metal oxides such as TiO_2 and ZnO NPs, and semiconductors such as silicon and ceramics.

(iii) **Organic-based nanomaterials**: These include NMs made mostly from organic matter, excluding carbon-based or inorganic-based NMs.

(iv) **Composite-based nanomaterials**: Composite NMs are multiphase NPs and NSMs with one phase on the nanoscale dimension that can either combine NPs with other NPs or NPs combined with larger or with bulk-type materials (e.g., hybrid nanofibers) or more complicated structures, such as a metal-organic frameworks. The composites may be any combinations of carbon-based, metal-based, or organic-based NMs with any form of metal, ceramic, or polymer.some examples are

Nanostructure	Size
glucose	1 nm
DNA	2.2–2.6 nm
average size of protein (rubisco monomer)	3–6 nm
haemoglobin	6.5 nm
micelle	13 nm
ribosomes	25 nm

3. Classification of nanomaterials based on dimension and structure

Nanomaterials can be categorized based on dimensions and their structural configuration.

A. According to their origin nanomaterials are classified as:

1. **Natural nanomaterials:** Nanomaterials which are belonging to resource of nature are defined as natural nanometer. As per examples virus, protein molecules including antibody originated

from nature are some natural nano structured materials. In addition following are few examples, mineral such as clays,natural colloids, such as milk and blood (liquid colloids), fog (aerosol type), gelatine (gel type),mineralised natural materials, such as shells, corals and bones,Insect wings and opals,Spidersilk,Lotus leaf and similar(Nasturtium,). Gecko feet,volcanic ash, ocean spray etc

2. **Artificial nanomaterial**: Artificial nanoparticles are those which are prepared deliberately through a well-defined mechanical and fabrication process. The examples of such materials are carbon nanotubes, semiconductor nanoparticles like quantum dots etc.

B.On the other hand according to the dimensions nanomaterials also can be divided into zero dimensional, one dimensional, two dimensional and three dimensional nano materials. (Fig. 1)

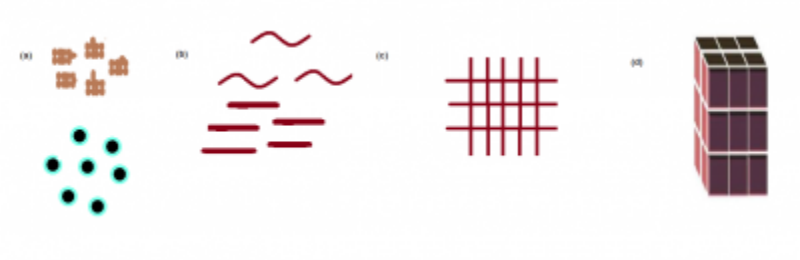


Fig. 1 Different dimensional Nanomaterials (a) 0-D spheres and clusters, (b) 1-D nanofibers, wires,and rods, (c) 2-D films, networks, (d) 3-D nanomaterials.

1. **Zero dimensional(0-D**):These nanomaterials have Nano-dimensions in all the three directions. Metallic nanoparticles including gold and silver nanoparticles and semiconductor such as quantam dots are the perfect example of this kind of nanoparticles. Most of these nanoparticles are spherical in size and the diameter of these particles will be in the1-50 nm range. Cubes and polygons shapes are also found for this kind of nanomaterials.

2. **One dimensional(1-D):**In these nanostructures, one dimension of the nanostructure will be outside the nanometer range. These include nanowires, nanorods, and nanotubes. These materials are long (several micrometer in length), but with diameter of only a few nanometer.

Nanowire and nanotubes of metals, oxides and other materials are few examples of this kind of materials

3. **Two dimensional(2-D**):In this type of nanomaterials, two dimensions are outside the nanometer range. These include different kind of Nano films such as coatings and thin-film-multilayers, nano sheets or nano-walls. The area of the nano films can be large (several square micrometer),but the thickness is always in nano scale range

4. **Three Dimensional(3-D):**All dimensions of these are outside the nano meter range. These include bulk materials composed of the individual blocks which are in the nanometer scale (1-100 nm)

C. On the basis of structural configuration nanomaterials can be classified into four types:

Carbon Based Nano materials: The nature of this kind of nanomaterials is hollow spheres, ellipsoids, or tubes. Spherical and ellipsoidal configured carbon nanomaterials are defined as fullerenes, while cylindrical ones are described as nanotubes.

Metal Based Materials: The main component of these particles is metal. These nanomaterials include nanogold, nanosilver and metal oxides, such as titanium dioxide and closely packed semiconductor like quantum dots.

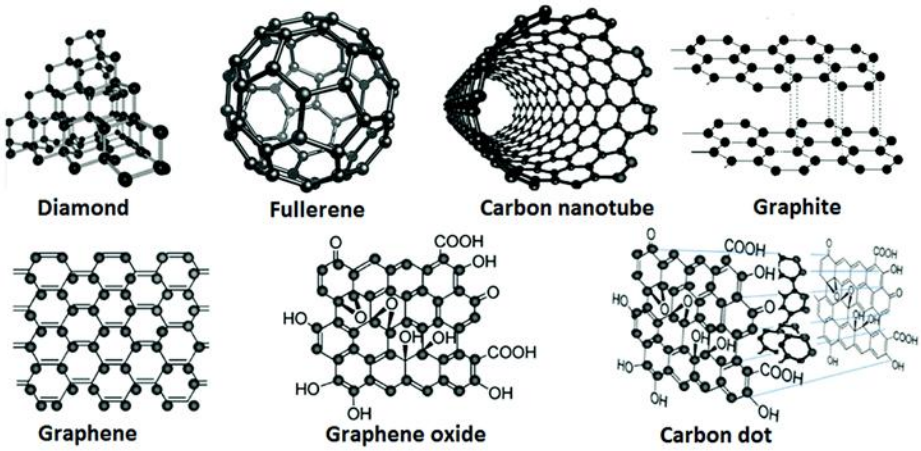
Dendrimers: Dendrimers are highly branched macromolecules with the dimensions nanometer-scale. The surface of a dendrimer posses numerous chain which can be modified to perform specific chemical functions. PAMAM dendrimer is the best illustration of this kind of materials.

Composites: Nanocomposite can be described as a multiphase solid material where at least one of the phases has one, two or three dimensions in nanoscale. The most common examples of these materials are colloids, gelsand copolymers.

NPs are broadly divided into various categories depending on their morphology, size and chemical properties. Based on physical and chemical characteristics, some of the well-known classes of NPs are given as below.

3.1. Carbon-based NPs

Fullerenes and carbon nanotubes (CNTs) represent two major classes of carbon-based NPs. Fullerenes contain nanomaterial that are made of globular hollow cage such as allotropic forms of carbon. They have created noteworthy commercial interest due to their electrical conductivity, high strength, structure, electron affinity, and versatility . These materials possess arranged pentagonal and hexagonal carbon units, while each carbon is sp2 hybridized.

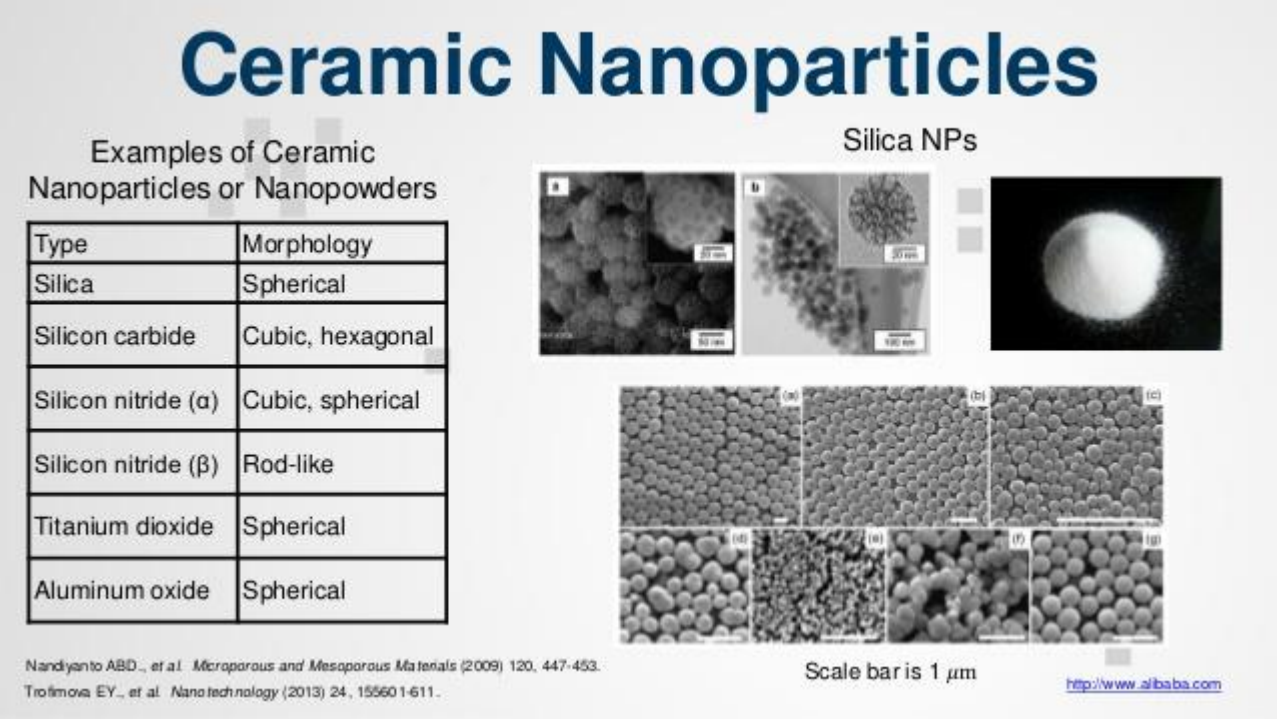


2. Metal NPs

Metal NPs are purely made of the metals precursors. Due to well-known localized surface plasmon resonance (LSPR) characteristics, these NPs possess unique optoelectrical properties. NPs of the alkali and noble metals i.e. Cu, Ag and Au have a broad absorption band in the visible zone of the electromagnetic solar spectrum. The facet, size and shape controlled synthesis of metal NPs is important in present day cutting-edge materials . Due to their advanced optical properties, metal NPs find applications in many research areas. Gold NPs coating is widely used for the sampling of SEM, to enhance the electronic stream, which helps in obtaining high quality SEM images

3.3. Ceramics NPs

Ceramics NPs are inorganic nonmetallic solids, synthesized via heat and successive cooling. They can be found in amorphous, polycrystalline, dense, porous or hollow forms (Sigmund et al., 2006). Therefore, these NPs are getting great attention of researchers due to their use in applications such as catalysis, photocatalysis, photodegradation of dyes, and imaging applications.



3.4. Semiconductor NPs

Semiconductor materials possess properties between metals and nonmetals and therefore they found various applications in the literature due to this property (Ali et al., 2017, Khan et al., 2017a). Semiconductor NPs possess wide bandgaps and therefore showed significant alteration in their properties with bandgap tuning. Therefore, they are very important materials in photocatalysis, photo optics and electronic devices (Sun, 2000). As an example, variety of semiconductor NPs are found exceptionally efficient in water splitting applications, due to their suitable bandgap and bandedge positions (Hisatomi et al., 2014).

3.5. Polymeric NPs

These are normally organic based NPs and in the literature a special term polymer nanoparticle (PNP) collective used for it. They are mostly nanospheres or nanocapsular shaped (Mansha et al.,

2017). The former are matrix particles whose overall mass is generally solid and the other molecules are adsorbed at the outer boundary of the spherical surface. In the latter case the solid mass is encapsulated within the particle completely . The PNPs are readily functionalize and thus find bundles of applications in the literature .

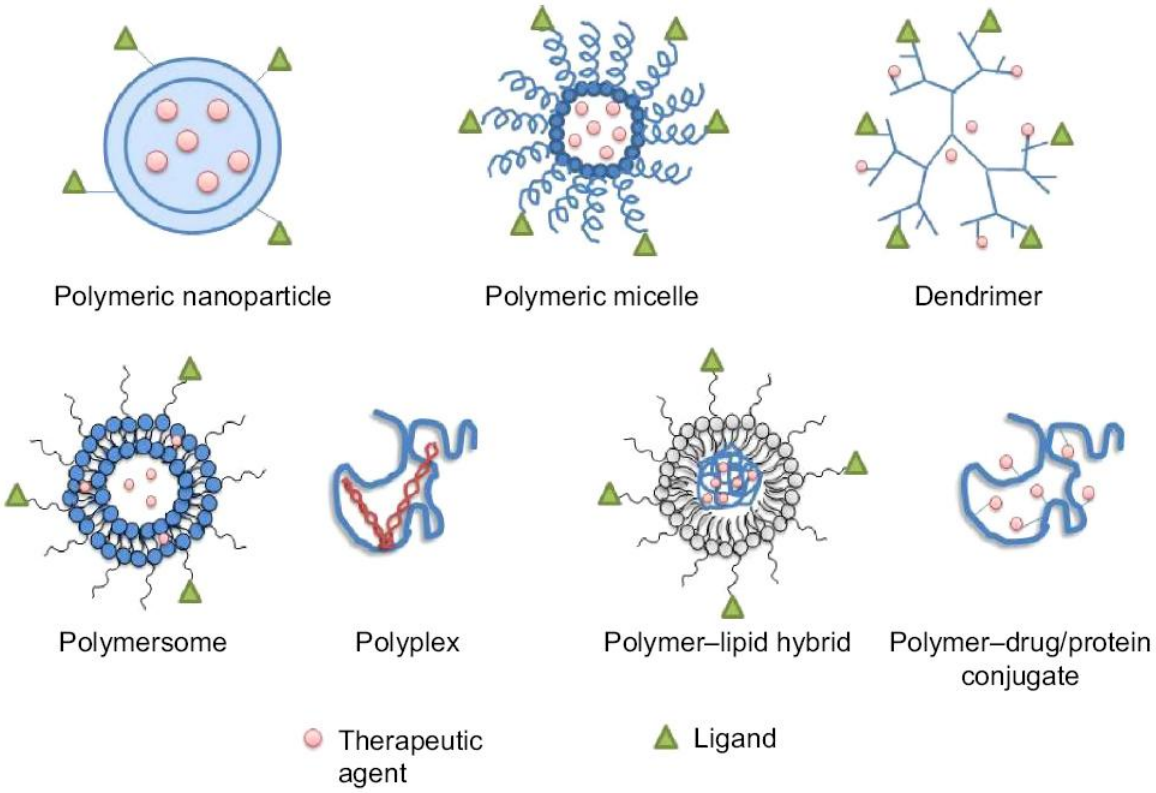


Figure 1 Schematic illustration of polymeric nanoparticle platforms.
Note: Blue color represents the polymeric platform.

3.6. Lipid-based NPs

These NPs contain lipid moieties and effectively using in many biomedical applications. Generally, a lipid NP is characteristically spherical with diameter ranging from 10 to 1000 nm. Like polymeric NPs, lipid NPs possess a solid core made of lipid and a matrix contains soluble lipophilic molecules. Surfactants or emulsifiers stabilized the external core of these NPs Lipid is a special field, which focus the designing and synthesis of lipid NPs for various applications such as drug carriers and delivery and RNA release in cancer therapy .

4. Classification of Nano particles

Liposomes

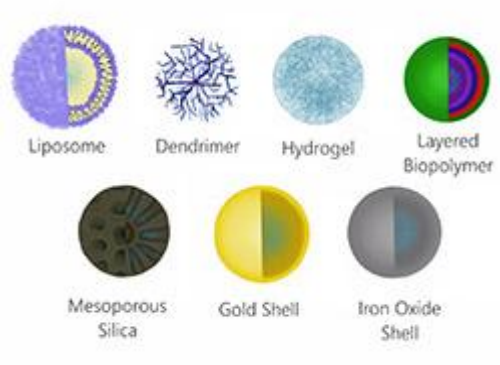
The first NP platform was the liposomes. Liposomes were first described in 1965 as a model of cellular membranes.2 Since then, liposomes have moved from a model in biophysical research to one of the first NP platforms to be applied for gene and drug delivery.

Albumin-bound

Albumin-bound NPs (nab) uses the endogenous albumin pathways to carry hydrophobic molecules in the bloodstream.7 Albumin naturally binds to the hydrophobic molecules with non-covalent reversible binding, avoiding solvent-based toxicities for therapeutics.8 As a result, this platform has been successfully adapted as drug delivery vehicle.

Polymeric

Polymeric NPs formed from biocompatible and biodegradable polymers have been extensively investigated as therapeutic carriers.11 Polymeric NPs are formulated through block-copolymers of different hydrophobicity.12 These copolymers spontaneously assemble into a core-shell micelle formation in an aqueous environment.13 Polymeric NPs have been formulated to encapsulate hydrophilic and/or hydrophobic small drug molecules, as well proteins and nucleic acid macromolecules



Hydrogel nanoparticles

Ceramic nanoparticles

Polymeric nanoparticles

Nanotubes and nanowires.

Nano sphere

Nano capsules

Nanotechnology

wants to control the smallest structures built of atoms and molecules. It is con-nected with colloidal chemistry and physics, biol-ogy, medicine, pharmacy and engineering (materials and processes).

Nano particles (from Greek nanos – dwarf) are organic or inorganic solid particles. The dimension of nano particles is not defined in a uniform manner. a) particles in the sub micron range (< 1 ?m) ,

b) materials science : < 100 nm (nano scaled particles)

c) pharmaceutics : < 500 nm, < 1000 nm = 1?m

Nanoparticles are poised to change the future of science, engineering and technology, and research is proceeding at a swift pace.

In any case, the responsible application of nanotechnology to medicine boasts hopes for extending the human lifespan and improving quality of life. Some proponents even claim that disease and death could be eliminated in a matter of decades. With mental illness and substance use now leading causes of death in the United States, there is a desperate need to find better ways to prevent and treat these disorders.

Solid lipid nanoparticles

This is the new type of drug carrier system.it consist of spherical lipid particles in the NM range.it dispersed in water or in solution.

Polymeric Nanoparticles

Thses are the solid particles and the size in the range of 10_1000 mm

It is the combination of synthetic or semi synthetic polymers

Biodegradable polymeric nanoparticles,poly lactic acid,polyglycolicacid,polymethylmethycrylate, phospholipid hydrophobic core, polylactic glycolic acid

Ceramic nanoparticles

These are nano particles contains inorganic compounds like silica,titania and alumina.

Hydrogel nanoparticles

Polymeric system involving the self assembly and self aggregation of natural polymer amphiphile s cholesterol pullulan,cholesterol dextran and agarose cholesterol groups provide cross linking points.

Functionalist nano carriers

Proteins, enzyme, peptide etc.

Nano crystal and nano suspension

Aggregation of these particles in crystalline form.

Polymers for nanoparticles

Proteins

Gelatin,albumin,lectins,leguminous

Polysaccharide

Alginate,dextran,chitin,agarose

Conclusion

The new nano particles can be created arbitrarily by using artificial intelligence techniques.

The properties cannot be changed so it can be derived from the knowledge base.the user can easily understand about the nano particles and different kind of nano particles can be generated using this artificial intelligence techniques.

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