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Nano Materials- Emerging As Everyday Material and Processes

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Abstract: Nano science and nanotechnology are the study and applications of very small things. Nanomaterials can be used across in all the fields of science, such as chemistry, biology, physics, materials science, and engineering. Scientists and engineers are finding a various ways to tailor desired materials at the nanoscale. So that their properties such as higher strength, lighter weight, increased control of light spectrum and chemical reactivity can be used. The broad range of commercial products include stain-resistant and wrinkle-free textile and cosmetics are available today.In the present article a broad vision –a new dimensions in era of science on nano materials is focussed.

Key words: Nanoscale, optical filters, quantum effects, nanocoatings, bioelectronic devices.

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I. INTRODUCTION:

Nanoscale materials are defined as a set of substances where at least one dimension is less than approximately 100 nanometers. A nanometer is one millionth of a millimeter. Which is approximately 100,000 times smaller than the diameter of a human hair. Nanomaterials are of interest (fig.1) because these possess unique optical, magnetic, electrical and other properties at the nanoscale. These properties have the potential impact in electronics, medicine, and other fields.

Fig. 1. Nanomaterials

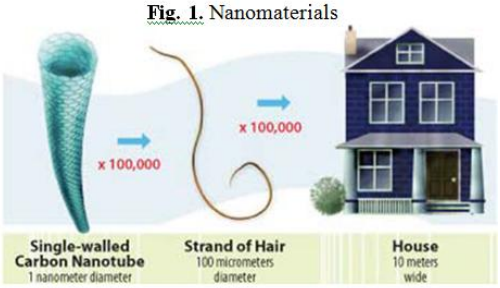
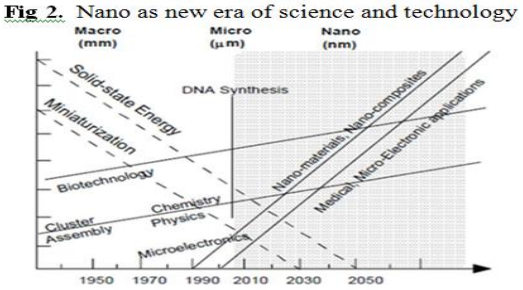


Fig 2. Nano as new era of science and technology



Nanomaterials hold potential to make supercomputers. These are small enough to be carried in a shirt pocket. Machines can be engineered that can repair damaged tissues when passed through the human body. Nanostructured materials are used in sensors, optical filters, low-threshold laser, controlled drug delivery and biological detection.

Nano medicine is a relatively new area of biotechnology. The possibilities for new therapies and surgeries to treat illnesses and diseases such as cancer, seem endless. The concept of nano robots and cell repair machines is also viable. Different types of nanoparticles are being studied for applications in nano medicine. They can be carbon-based skeletal-type structures, such as the fullerenes, or micelle-like, lipid-based liposomes. They possess numerous applications in drug delivery and the cosmetic industry. At the nano scale these materials can have different properties because their relative surface area to volume ratio is inceased. Another reason to have such properties is new quantum effects. These properties are not found in their bulk part. Nano materials have a much greater surface area to volume ratio than their conventional forms.It can lead to greater chemical reactivity and affect their strength. Quantum effects can become more important in determining properties and characteristics of materials at the nanoscale. They lead to novel optical, electrical and magnetic behaviours.

Occurrence :

Some nanomaterials occur naturally. The nanomaterials are engineered and designed for a particular product and already being used in many commercial products and processes. They can be found as sunscreens, cosmetics, sporting goods, stain-resistant clothing, tires, electronics, as well as many other everyday items, and are used in medicine for purposes of diagnosis, imaging and drug delivery.

History of nanomaterials:

People were coming across various nanosized objects and the related nanolevel processes, and using them in practice long before the start of nanoera. Intuitive nanotechnology antiquities developed spontaneously, In fact, they were not understanding the nature of these objects and processes. At that time small particles of various substances possessed properties different to those of the same substances with larger particle size was known, They were not knowing the reason for that.

Thus, people were engaged in nanotechnology subconsciously. They could not guess
that they were dealing with the nanoworld phenomena. In many instances
secrets of ancient nanoproduction simply passed from generation to generation,

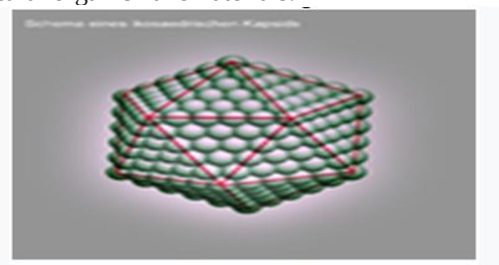
People knew and used natural fabrics: flax, cotton, wool, silk.They were able to cultivate them and process into products. They did not know what makes these fabrics special? Infact ,they have a developed network of pores with the size of 1-20 nanometers. They were not aware that these are typical nanoporous materials. Natural fabrics possess absorption properties due to their nanoporous structure. Fabrics absorb sweat well, quickly swell and dry.

People mastered the ways of preparing bread, wine, beer, cheese and
other foodstuffs since ancient times. They did not know that the fermentation processes at nanolevel.

In Ancient Egypt it was rather common to dye hair black. For a long time it was
believed that the Egyptians used mainly natural vegetative dyes like henna and black hair
dye. Recently, Ph.Walter conducted research on hair samples from ancient Egyptian burial sites, It showed that hair was dyed in black with paste from lime, lead
oxide and small amount of water. In the course of the dyeing process nanoparticles of
galenite (lead sulfide) were formed. Natural black hair color is provided with a pigment
melanin. It is spread in hair keratin. The Egyptians were able to make the dyeing paste react with sulfur, which is part of keratin. They received galenite particles of few nanometers. That provided even and steady dyeing.

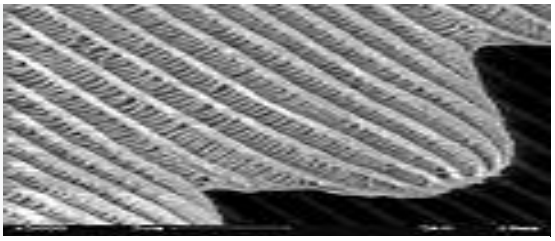
The British museum boasts Licurg's bowl as part of its heritage. This outstanding
bowl is made by glass makers of Ancient Rome. This bowl possesses unusual optical properties. It changes color with change of location (inside or outside) of the light source. In natural light the bowl is green, if illuminated from within, it turns red. The analysis of fragments of the bowl, carried out in the laboratories of General Electric in 1959 for the first time. They showed that the bowl consists of usual soda-lime-quartz glass and has about 1% of gold and silver, and also 0,5 % of manganese as components. The researchers then assumed, that the unusual color of glass is provided by colloidal gold. Later, scientists discovered particles of gold and silver from 50 to 100 nanometers in size using an electronic microscope.

Natural organic nanomaterials: Biological systems feature natural, functional nanomaterials. The structure of chalk and viruse, the wax crystals covering a lotus leaf, spider and spider-mite silk[2], the blue hue of tarantulas,butterfly wing scales, natural colloids like milk and horny material. Even our own bone matrices are all natural organic nanomaterials.



Viral capsid

Lotus effect hydrophobic effect with self-cleaning ability



SEM micrograph of a butterfly wing scale

Peacock feather

Crystal Opal (Brazil)

Blue hue of a species of tarantula.

II. APPLICATIONS:

Nano materials are already in commercial use, Very broad range of commercial products is available today. Stain-resistant and wrinkle-free textiles, cosmetics, electronic equipments, paints and varnishes are available in market. Nanocoatings and nanocomposites are finding uses in diverse consumer products, such as windows, sports equipment, bicycles and automobiles. There are novel UV-blocking coatings on glass bottles .These protect beverages from damage by sunlight, Nano-clay composites. Nanoscale titanium dioxide, for instance, is finding applications in cosmetics, sun-block creams and self-cleaning windows. Nanoscale silica is being used as filler. It includes cosmetics and dental fillings.

nanoscale additives to or surface treatments of fabrics. These can provide light weight ballistic energy deflection in personal body armor. It can help them to resist wrinkling, staining, and bacterial growth.

Eyeglasses, computer and camera displays, windows, and other surfaces are coated with clear nanoscale films. The film deposition can make them water- and residue-repellent, antireflctive, self-cleaning, resistant to ultraviolet or infrared light, antifog, antimicrobial, scratch-resistant or electrically conductive.

Nanoscale materials enable us washable and durable smart fabrics. Nano equipments with flexible nanoscale sensors[3] have capabilities to moniter health [4],

Lightweighing of cars, trucks, airplanes, boats, and space craft could lead to significant fuel savings. Nanoscale additives in polymer composite materials are being used in baseball bats, tennis rackets, bicycles, motorcycle helmets, automobile parts, luggage, and power tool housings, These materials make them lightweight, stiff, durable, and resilient. Carbon nanotube sheets are now being produced for use in next-generation air vehicles. For example, the combination of light weight and conductivity makes them ideal for applications such as electromagnetic shielding and thermal management.

III. CONCLUSION:

Nanoparticles have potential applications in different fields. Tailored nano-particles are specifically designed and formed with customized physical properties in order to fulfill the requirements of specific applications. They can serve as the end product, like sensor for special purposes, pharmaceutical drugs and quantum dots. They can serve as components in end products, as in the case of carbon black in rubber products. The physical properties of the nanomaterials play a key role in their performance. The novel physical and chemical properties of nanomaterials provide interface electronic signal transduction with DNA recognition events. These materials are used to design advanced bio-electronic devices with innovative functions. There is currently little available information on the explosion and inflammable risk of these materials.

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