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Nanoscience: A review

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Abstract
The recent development in the field of science is well known. Nano-science is an important part of science development. Nano-particle plays vital role in present era because of its nano size and structural properties. It is well known that the field of Nanotechnology is exiting. It is imperative that national and international regulatory bodies cooperate closely not only with each other, but also with academia and industry, in developing harmonized terminology and standards, a framework for health and environmental risk assessment and, based on that, the necessary regulations and guidelines so that nanomaterials and nanotechnology can be developed responsibly. A large number of chemical reaction and process depends on nano-particles.

Keywords: nanoscience, nanotechnology

Introduction

Nanotechnology derives from the Greek word 'Nano' which means dwarf or gnome. Nanotechnology is basically transformation or manipulation of matter on a nanoscale (down to 1/100,000 the width of a human hair or 1 billionth of a meter). Its main objective is to produce Nano-scale materials that can provide benefit to the society by availing Nano-scale materials. The idea of nanotechnology was originally given by K. Eric Drexler, an American Engineer, which he defines it as "Technology based on the manipulation of individual atoms and molecules to build structures to complex atomic specifications".

In other words, we can also say that it deals with synthesis, characterization, exploration, and exploitation of nanostructured materials. A revolution in materials science and engineering is taking place as researchers find ways to pattern and characterize materials at the nanometer length scale on this scale.

Nanomaterials mainly can be classified into to two types

1. Non-intentionally-made nanomaterial's
2. Intentionally-made

Non-intentionally-made nanomaterial's, which denotes Nano-sized particles or materials that belong naturally in that size range while on the other hand Intentionally-made the environment or that are produced by human activity without intention, which denotes nanomaterials produced from a defined fabrication process.

If we observe some of the properties of Some physical and chemical material properties vary from those of the bulk structured materials of the same composition; for example, the theoretical strength of nanomaterial's can be reached or quantum effects may appear; crystals in the nanometer scale have a low melting point and reduced lattice constants, since the number of surface atoms or ions becomes a significant fraction of the total number of atoms or ions and the surface energy plays a significant role in the thermal stability.

We can say that nanotechnology now has become a very growing field where we can see the possibility to bring revolution in many areas. For example, some of them are medical, Engineering & Robotics. We can see that there are Nano robots which is very useful in several fields. In this paper the recent development of nano-science is discussed. The technology which can actually bring the revolution and it has a great potential to change the way how engineering mind can approach the problem in a greater way.

Properties

The nanomaterials field includes sub-fields which develop or study materials having unique properties arising from their nanoscale dimensions. There are many different views of precisely what is included in nanotechnology. In general, however, most agree that three things are important: -

1. Small size, measured in 100s of nanometers or less
2. Unique properties due to small size
3. Control the structure and composition on the nanometer scale in order to control the properties

The nanoparticles are smaller but consist high adsorption capability. Absorption of solar radiation in photovoltaic cells is much higher in nanoparticles than it is in thin films of continuous sheets of bulk material.

Methods to see or visualize Nanotechnology Materials

Optical (light) Microscopes focus visible light through "lenses" to make a magnified image. They work essentially like a magnifying glass.

Electron Microscopes uses electron beams instead of visible light, enabling resolution of features down to a few nm.

Scanning Probe Microscopes (SPM) of various types trace surface features by movement of a very fine pointed tip mounted on a flexible arm across a surface.

Nanotechnology will help us to create more powerful weapons, both lethal and non-lethal. This is a serious concern which scientists and the countries all over the world need to

keep in mind these weapons can be used by the notorious elements of the society to cause destruction and harm people. There is not enough data to know for sure if nanoparticles could have undesirable effects on the environment. While it is possible to buy a packet of nanotechnology, a gram of nanotubes. The real value of the nanotubes would be in their application, whether within existing industry, or to enable the creation of a whole new one.

Now we can say that, the field of Nanotechnology is exiting. It is imperative that national and international regulatory bodies cooperate closely not only with each other, but also with academia and industry, in developing harmonized terminology and standards, a framework for health and environmental risk assessment and, based on that, the necessary regulations and guidelines so that nanomaterials and nanotechnology can be developed responsibly. This will be helpful in optimizing the benefits of nanotechnology during minimizing and controlling the risks. If we start progressing in this area continuously we can certainly bring great changing in this area.

Nanotechnology, like any other branch of science, is mainly concerned with understanding how nature works. We have discussed how our efforts to produce devices and manipulate matter are still at a very initial stage compared to nature. Nature has the ability to design highly energy efficient systems that operate precisely and without waste, fix only that which needs fixing, do only that which needs doing, and no more and we human also show to the nature that using our intelligent brain we can develop device that can be a super example for the nature.

Nano-particle synthesis

There are two approaches to the synthesis of nanomaterials: bottom-up and top down. In the bottom-up approach, molecular components arrange themselves into more complex assembly's atom-by-atom, molecule-by-molecule, cluster-by cluster from the bottom. In top down method, destructive approach is used. Starting from larger molecule, which decomposed into smaller units and then these units are converted into suitable NPs example of this method are grinding/milling, CVD, physical vapour deposition (PVD) and other decomposition techniques achieve. In case of bottom-up synthesis, this approach is employed in reverse as NPs are formed from relatively simpler substances, therefore this approach is also called building up approach. Examples of this case are sedimentation and reduction techniques. It includes sol gel, green synthesis, spinning, and biochemical synthesis.

Development

A fuel cell is an energy conversion device that electrochemically converts chemical energy held within two reactants, a fuel and an oxidant, into electrical energy. The source fuel could be almost anything that can be oxidized, including hydrogen, methane, propane, methanol, diesel fuel or gasoline. The only byproducts are water and a small amount of nitrous oxide if air is used as the oxidizer. Fuel cells create electricity chemically, rather than by combustion, they are not subject to the thermodynamic laws that limit a conventional power plant (see "Carnot Limit" in the glossary). Therefore, fuel cells are more efficient in extracting energy from a fuel. Waste heat from some cells can also be harnessed, boosting system efficiency still further. Nano technology plays an important role in case of fuel cell.

Catalysis has been defined as the process by which chemical reaction rates are altered by the addition of a substance (the catalyst) that is not itself changed during the chemical reaction. Catalysts are usually used so that chemical reactions can occur at temperatures and pressures low enough for producers to use economically priced equipment or to ensure that the rate of production of a desired product is greater than the rates of production of undesirable byproduct. Nano particle also used as nano catalysis.

It is reported that, nano particle on the mechanical properties at different ages of concrete. The influence of Nano particles on mechanical properties and durability of concrete has been investigated with the improvement. Different mixtures have been studied including nano-silica (NS), nano-clay (NC) or both NS and NC together with different percentages. Mechanical properties have been investigated such as compressive and flexure strength through testing concrete prisms 40, 40 and 160 mm at 7, 28 and 90 days in order to explore the influence of these nano particles on the mechanical properties of concrete. After the results of this study it is found nano particles can be very effective in improving mechanical properties of concrete, nano-silica is more effective than nano clay in mechanical properties and wet mix gives higher efficiency than dry mix. The wet mix for nano clay is extra efficient than dry mix around 24% and 32% improvement in compressive and flexure strength.

Bimetallic nanoparticles are highly reactive and have great promise as catalysts for energy production in Direct Methanol Fuel Cells (DMFCs) which provide a stable, long lasting power source while producing little or no waste. In the methanol electro-oxidation process the activity of a platinum catalyst can be enhanced by the addition of metal promoters. Ruthenium has the greatest effect andis currently the favoured promoter Half-cell conditions.

Conclusion

Nano science has attracted a lot of attention of scientist. It used in various field. A large number of chemical reaction depends only on nano-catalysis. Nano-particle synthesis take place mainly by two methods; bottom down and top up. Nano-particles plays crucial role in process of fuels cell, energy production in direct methanol fuel cell. The influence of Nano particles on mechanical properties and durability of concrete is investigated.

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