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A Study on Trending Research in Material Science

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Abstract – Material science is a new revolution in the field of science. Presently, many researches are going on so as to take more and more benefits of this technology. It has a lot of scope in future. Nano-particles are very small in size. Material science comprises the knowledge from physics, chemistry and biology and hence becomes the most powerful technology which can offer a number of services to the living persons making their lives more comfortable. At first, nano-particles are identified and characterized chemically so a s to examine the risks offered through material science. It is observed that for the purpose of examining the ill effects and hazards, it is necessary to understand the chemical properties of particles. The current article highlights the scope of nano technology in electronic networks.

Keywords: Nano Technology, Size, Particle

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INTRODUCTION

There are many chemical properties which can be referred so as to characterize the materials and some of these properties include boiling point, melting point, molecular weight and structure etc. The information regarding performance and purity of a product can be determined with the help of its formulation and manufacture details.

The identification and characterization of nano particles chemically is also supposed to be very essential. However, the task of identifying and characterizing of nano particles is found to be difficult one due to the fact that the nano particles have much complexity and diversity. It is also observed that a number of properties are needed to be examined for the purpose of characterizing the nano-particles for assessing risks.

In case of nano materials, the chemical properties such as size of particle, molecular weight and structure are considered as very critical. In the same manner, the electrical properties such as surface characteristics, conductivity and dispersion etc. play a major role in nano materials.

There may be a number of different processes to make a given nano material which may result in the generation of many of derivatives of a single material. An example is nano-tube which can be manufactured with the help of a number of different processes that can yield products having dissimilar chemical and physical properties.

There are many methods that are available for the characterization of nano materials but these methods may be insufficient to examine their risks and hazards. Although, it is noticed that the properties like boiling point are not sufficient for the task of characterizing of nano materials.

It is also observed that the chemical properties of nano-materials tend to vary at nano scale. Reactivities of nano materials are found to be more than that of bulk objects because of the fact that the number of surface atoms in former is found to be large as compared to latter.

There are some points which are related to chemical properties which are mentioned below:

1) The reason behind the variation in behaviour of nano materials at nano scale is observed to be the prevalence of surface. Since in nano particles, a number of surface atoms are found; therefore, it is quite difficult to determine the electrical transport with the help of bulk procedure.

2) As the quantity of surface atoms is larger in nano-materials as compared to that of atoms; therefore, average energy is found to be more in former. For instance, catalytic materials have higher reactivity because the size of catalyst tends to minimize at nano scale.

3) Structure and nature of chemical bonding at the surface play a vital role in identifying the level of interactions between particles.

4) Surface properties can be changed or controlled with the help of molecular layers which can be used to intercede the interaction between nano particles.

It is observed that the motion type of electrons can be helpful in determining the chemical properties of a material. These chemical properties may include zeta potential and photo catalytic properties.

Metallic nano particles are found to be more flexible as compared to other nano structures as they have the moderate control on their size and structure.

Since the nano particles of gold and silver have the tendency of bio-conjugation therefore; they have the much scope in nano-biotechnology as compared to other metallic nano-structures.

The resonance wavelength of metal surface depends on the structural and di-electrical properties of nano-particles. The usage of these kind of nano particles is found in cancer treatments, cell labeling, detection of bio-molecules etc.

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It is also pointed out that gold nano particles are mostly used in the germination of seeds due to their property of inertion biologically. They are also used in micro-RNAs expression which is used to control various processes in plants because the level of cytotoxicity is found much more in gold nano particles as compared to silver nano particles.

Since the size of metal oxide nano particles is limited therefore, they tend to show distinctive chemical properties. The size of particles plays a critical role in affecting the major groups of a material. The electronic properties of the oxide such as lattice symmetry and size come under the structural characteristics and these structural and electronic properties have the tendency to relate with the chemical properties of nano-particles.

There are many applications of the particles of metal oxides in plant technology. For example, the percentage germination can be enhanced with the help of silicon dioxide keeping in mind that the oxide must be nano-sized.

Similarly, the growth of root of the plants can be increased with the help of alumina nano particles. These nano particles have some bio-applications as well because they have the tendency of showing magnetic properties which relate their connection with some biological system and domain of magnets.

Nano materials are playing a vital role in the development of flexible electronics. Only by manipulating the nanoscale structure of materials can we create components with the necessary electronic properties which can also be made flexible.

Recently, a new transparent conductor material has been commercialized - silver nanowires, which form a sparse network across a continuous layer. A silver nanowire ink developed by Cambrios has been used to create touch screen devices like all-in-one PCs and laptops. Because the ink is inherently flexible, unlike ceramic indium tin oxide , devices with curved or flexible screens are now in the pipeline.

In the future, as manufacturing technology advances, it is likely that graphene will become a dominant material in flexible electronics. Other materials will struggle to match the combination of its superb electrical conductivity, flexibility, and physical strength.

Research into using graphene to build many of the necessary components for flexible electronic devices is already well advanced. As well as transparent conductors, graphene can also perform exceptionally well in battery electrodes, conducting interconnects, and even individual transistors. It will be fascinating to watch the graphene story unfold as the commercial fabrication technologies mature and manufacturers begin to adopt the wonder material in their products.

Flexibility is a major breakthrough in the world of electronics, which will enable a new paradigm in design and functionality for the devices which our modern lives depend upon. Flexible devices have already begun to make their way into the commercial realm, and the next few years are bound to see huge changes brought on by this additional dimension which is now available to electronics manufacturers.

After more than 20 years of basic nano science research and more than fifteen years of focused R&D under the NNI, applications of material science are delivering in both expected and unexpected ways on material science's promise to benefit society.

Material science is helping to considerably improve, even revolutionize, many technology and industry sectors: information technology, homeland security, medicine, transportation, energy, food safety, and environmental science, and among many others. Described below is a sampling of the rapidly growing list of benefits and applications of material science.

Other computing and electronic products include Flash memory chips for smart phones and thumb drives; ultra-responsive hearing aids; antimicrobial/antibacterial coatings on keyboards and cell phone casings; conductive inks for printed electronics for RFID/smart cards/smart packaging; and flexible displays for e-book readers.

Nanoparticle copper suspensions have been developed as a safer, cheaper, and more reliable alternative to lead-based solder and other hazardous materials commonly used to fuse electronics in the assembly process.

DISCUSSION

Material science is finding application in traditional energy sources and is greatly enhancing alternative energy approaches to help meet the world's increasing energy demands. Many scientists are looking into ways to develop clean, affordable, and renewable energy sources, along with means to reduce energy consumption and lessen toxicity burdens on the environment:

Using magnetic random access memory (MRAM), computers will be able to "boot" almost instantly. MRAM is enabled by nanometer-scale magnetic tunnel junctions and can quickly and effectively save data during a system shutdown or enable resume-play features.

Ultra-high definition displays and televisions are now being sold that use quantum dots to produce more vibrant colors while being more energy efficient.

Flexible, bendable, foldable, rollable, and stretchable electronics are reaching into various sectors and are being integrated into a variety of products, including wearables, medical applications, aerospace applications, and the Internet of Things. Flexible electronics have been developed using, for example, semiconductor nanomembranes for applications in smartphone and e-reader displays.

Other nanomaterials like graphene and cellulosic nanomaterials are being used for various types of flexible electronics to enable wearable and "tattoo" sensors, photovoltaics that can be sewn onto clothing, and electronic paper that can be rolled up. Making flat, flexible, lightweight, non-brittle, highly efficient electronics opens the door to countless smart products.

Material science is improving the efficiency of fuel production from raw petroleum materials through better catalysis. It is also enabling reduced fuel consumption in vehicles and power plants through higher-efficiency combustion and decreased friction.

Material science is also being applied to oil and gas extraction through, for example, the use of material science-enabled gas lift valves in offshore operations or the use of nanoparticles to detect microscopic down-well oil pipeline fractures.

Researchers are investigating carbon nanotube "scrubbers" and membranes to separate carbon dioxide from power plant exhaust.

CONCLUSION

Material science has greatly contributed to major advances in computing and electronics, leading to faster, smaller, and more portable systems that can manage and store larger and larger amounts of information. These continuously evolving applications include:

Transistors, the basic switches that enable all modern computing, have gotten smaller and smaller through material science. At the turn of the century, a typical transistor was 130 to 250 nanometers in size. In 2014, Intel created a 14 nanometer transistor, then IBM created the first seven nanometer transistor in 2015, and then Lawrence Berkeley National Lab demonstrated a one nanometer transistor in 2016! Smaller, faster, and better transistors may mean that soon your computer's entire memory may be stored on a single tiny chip.

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