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INNOVATIVE APPLICATIONS OF NANOCHEMICAL ENGINEERING IN HEALTHCARE, ENERGY, AND INDUSTRIAL SYSTEMS

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Abstract: The nanochemical prefix was given to nanochemical engineering when scientists observed the odd changes on materials, chemical combination when they were in nanometer-scale size& nanochemical reaction. Several chemical modifications on nanometer scaled structures, approves effects of being size depend on their reaction.
Nanochemical engineering can be characterized by concepts of size, shape, self-assembly, defects and chemical nano –chemical composition; so, the synthesis of any new nanochemical-construct is associated with all these concepts. Nanochemical-construct synthesis is dependent on how the surface, size and shape will lead to selfassembly of the building blocks into the functional structures; they probably have functional defects and might be useful for chemical engineering, environmental engineering. Mechatronics engineering, electronic, photonic, biomedical application or bioanalytical problems, biophysics.

Keywords: Nano chemical engineering, chemical engineering, materials, chemical combination.

I. INTRODUCTION

Nanochemical Engineering is the combination of chemical engineering and nanotechnology. It was first proposed by Indian Nanotechnologist Prof Shantanu *Kumar sahu*. So *shantanu kumar sahu* is called as father of *Nanochemical engineering* .so in Nanochemical engineering is associated with synthesis of building blocks which are dependent on size, surface, shape defect properties, chemical combination & chemical reaction. Nonchemical engineering is being used in chemical, materials and physical, science as well as engineering, biological, biochemical and biomedical applications. Nanochemical engineering and other nanotechnology have the same core concepts but the usages of those concepts are different field.

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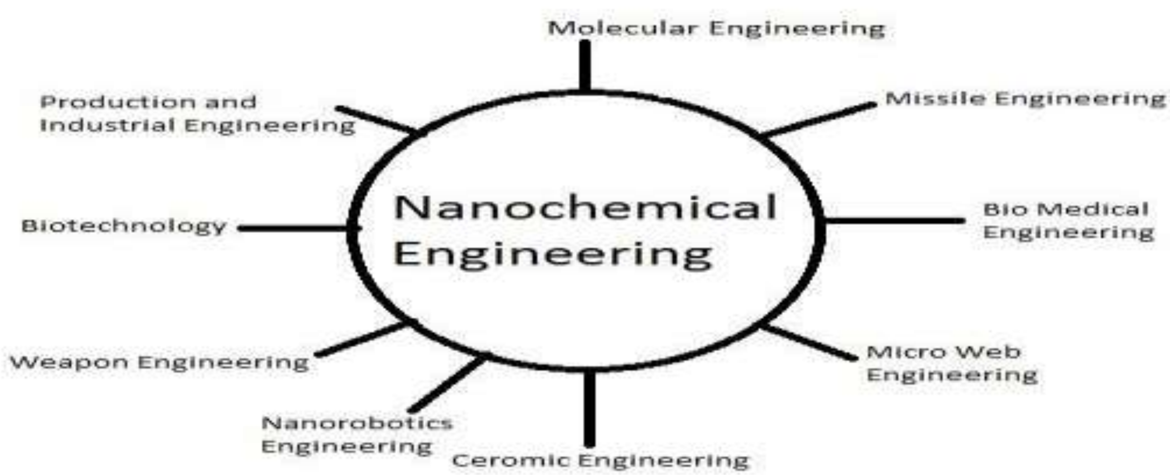
be useful for chemical engineering, environmental engineering. Mechatronics engineering, electronic, photonic, biomedical application or bioanalytical problems, biophysics.

In chemical reaction Silica, gold, polydimethylsiloxane, cadmium selenide, iron oxide and carbon are materials that show the transformative power of nanochemical engineering. Nanochemical engineering can make the most effective contrast agent of MRI out of iron oxide (rust) which has the ability of detecting cancers and even killing them at their initial stage Silica can be used to bend or stop light in its tracks. Developing countries such as India also use silicone to make the circuits for the fluids to attain developed world's pathogen detection abilities. Carbon has been used in different shapes and forms and it will become a better choice for nanoelectronics materials.

Overall, nanochemical engineering is not related to the atomic structure of compounds in chemical reaction. Rather, it is about different ways to transform materials into solutions to solve problems. Nanochemical mainly deals with degrees of freedom of atoms in the periodic table however nanochemical engineering brought other degrees of freedom that controls material's behaviors.

Nanochemical engineering methods can be used to create carbon nanochemical materials such as carbon nanotubes (CNT), grapheme and fullerenes which have gained attention in recent years due to their remarkable mechanical, electrical properties & chemical reaction.



A. Nanochemical engineering topography

Nanochemical engineering topography refers to the specific surface features which appear on the nanochemical engineering scale. In industry, applications of nanochemical engineering topography typically encompass electrics chemically, technologically artificially produced surface features. However, natural surface features are also included in this definition, such as nano-level cell interactions and the textured organs of animals, plants other living beings. These nanochemical engineering topographical features in nature serve distinctive purposes that aid in regulation and function of the biotic organism, as nanochemical engineering topographical features are extremely sensitive in cells of living organism.

Nanochemical engineering lithography

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Nanochemical engineering lithography is the process by which nano chemical engineering topographical etchings are artificially produced on a surface& chemical combination. Many practical applications make use of nano chemical engineering lithography, including semiconductor chips in computers& other industry use. There are many types of nanolithography, which include:

- Nanochemical engineering photolithography
- Nanoelectron beam lithography (EBL)
- X-ray nanochemical engineering lithography
- ExtremeNano ultraviolet lithography (EUVL)
- Light coupling nanochemical lithography (LCM)
- Scanning probe microscope (SPM)
- Nanolithography
- Dip-Pen nanolithography
- Soft nanochemical lithography

Each nanochemical engineering lithography technique has varying factors of resolution, time consumption, and cost. There are three basic methods used by nanochemical electronics lithography. One involves using a resist material which acts as a "mask" to cover and protect the areas of the surface that are intended to be smooth. The uncovered portions can now be etched away, with the protective nanomaterial acting as a stencil. The second method involves directly carving the desired pattern. Etching may involve using a beam of quantum nanoparticles, such as nanoelectrons or light, or nanochemical methods such as nano oxidation or SAM's (self-assembled monolayers). The third method places the desired pattern directly on the surface, producing a final product that is ultimately a few nanometers thicker than the original surface. In order to visualize the surface to be fabricated, the surface must be visualized by a nanochemical resolution microscope, which include the scanning probe microscope (SPM) and the AFM. Both microscopes can also be engaged in processing the final things.

II. APPLICATIONS

a) Medicine

One highly researched application of nanochemical engineering is medicine. It is also use in biomedical engineering application. A simple skin-care product using the technology of nanochemistry is sunscreen. Sunscreen contains nano chemical engineering particles of zinc oxide and titanium dioxide. These nanochemical engineering protect the skin against harmful UV light by absorbing or reflecting the light and prevent the skin from retaining full damage by photo excitation of electrons in the nanochemical particle. Effectively, the excitation of the particle blocks skin cells from DNA damage & cell damage.

b) Drug delivery

In Bioinformatics the nanochemical engineering, emerging methods of drug delivery involving nanotechnological methods can be advantageous by improving increased bodily response, specific targeting, and efficient, non-toxic metabolism. Many nanotechnological methods and materials can be functionalized for drug delivery. Ideal materials employ a controlled-activation nanomaterial to carry a drug cargo into the body. Mesoporous silica nanoparticles (MSN) have been increasing in research popularity due to its large surface area and flexibility for various individual modifications while demonstrating high resolution performance under imaging techniques. Activation methods greatly vary across nanochemical engineering drug delivery molecules, but the most commonly used activation method uses specific wavelengths of light to release the cargo. Nanochemicals-controlled cargo release uses low intensity light and plasmonic heating to release the cargo in a variation of MSN containing gold molecules. The two-photon activated phototransducer (2-NPT) uses near IR wavelengths of light to induce breaking of a disulfide bond to release the cargo. Recently, nano chemical engineering diamonds have demonstrated potential in drug delivery due to non-toxicity, spontaneous absorption through the skin, and ability to enter the blood-brain barrier.

c) Tissue engineering

Because cells are very sensitive to nano chemical engineering topographical features, optimization of surfaces in tissue engineering has pushed the frontiers towards implantation. Under the appropriate conditions, a carefully crafted 3dimensional scaffold is used to direct cell seeds towards artificial organ growth. The 3-D scaffold incorporates various nanochemical engineering scale factors that control the environment for optimal and appropriate functionality. The scaffold is an analog of the in vivo extracellular matrix in vitro, allowing for successful artificial organ growth by providing the necessary, complex biological factors in vitro. Additional advantages include the possibility of cell expression manipulation, adhesion, and drug delivery in bioinformatics.

d) Environmental Engineering

Nanochemical engineers have expertise to work on environmental problems related to sustainable energy, environmental management, and sustainability. There are several research problems related to air emissions and liquid and solid effluents from industrial and agricultural processes. One current problem is the development of a treatment wetland to manage sulfur and other inorganic compounds in flue gas desulfurization waste water from a coal burning power plant. The research involves both mathematical models and experimental work. Faculty and students from four departments are working with a consulting company as a multidisciplinary team. New technology development to address environmental problems and advance sustainability is a second area of research.

e) Application in Aerospace Engineering

We are pleased to present to you this special issue on nanochemical rocket propulsion. It is hoped that experts and nanochemical engineering experts alike will enjoy the discussion of a number of international research efforts that are taking place across the breadth of this diverse field, as conveyed by the authors of the papers appearing herein. The submitted papers certainly reveal the wide number of disciplines (Nanotechnology, chemistry, fluid dynamics, structures, engineering etc.) that currently play important roles towards ultimately producing effective chemical rocket systems.

f) Application of Rockety

Recently, an important milestone has been reached in the history of nanochemical rocket propulsion, with the retirement of the Space Shuttle. The end of one era brings the dawn of a new era in space transportation, with the anticipation that, with time, new and better flight vehicles will come on the scene and flourish in their respective applications. Almost surely, those new vehicles will still be propelled in large part by nanochemical engineering rocket systems, systems that have been updated and improved over those of the previous generation through the efforts of today’s researchers and engineers.

g) Application for Soldier

The Institute for Soldier Nanotechnologies (ISN) use the application of nanochemical engineering, deriving from a partnership between the United States Army and MIT, provided an opportunity to focus funding and research activities purely on developing amour to increase soldier survival. Each of seven teams produces innovative enhancements for different aspects of a future U.S. soldier bodysuit. These additional characteristics include energy-absorbing material protecting from blasts or ammunition shocks, engineered sensors to detect nanochemical engineering material and toxins, as well as built in nano devices to identify personal medical issues such as haemorrhages and fractures. This suit would be made possible with advanced nano-materials such as carbon nano chemical tubes woven into fibres, allowing strengthened structural capacities and flexibility; however, preparation becomes an issue due to inability to use automated manufacturing.

h) Application of Mechatronics

Nanochemical engineering use in Mechatronic Lab, it exploring various innovative micro/nano fabrication methods with applications in motion, orientation and biological sensing. The research group is innovating high-precision and ultrasensitive micro/nano sensing and probing devices to reach and explore science at the very bottom of the length scale. We provide an optimal multi-disciplinary research incubator for nurturing future researchers and professionals to take leadership roles in the emerging field of Nanochemical engineering systems. Our nanochemical engineering research interests center on the design, fabrication, characterization, electronics and controls development for high performance 3D nanochemical engineering systems. We develop and implement novel mechatronic principles to demonstrate classical applications in dynamic motion sensing as well as emerging applications in biomolecular probing and sensing.

i) Application in agriculture

Nanochemical engineering in agriculture has gained good momentum in the last decade with an abundance of public funding, but the stage of development is good, even though many methods became under the umbrella of agriculture. This might be attributed to a unique nature of farm production, which functions as an open system whereby energy and matter are exchanged freely. The scale of demand of input materials is always being large in contrast with industrial nano chemical engineering products with the absence of control over the input of the nano chemical materials in contrast with industrial nano chemical engineering products. Nanochemical engineering provides new agro nanochemical engineering agents and new delivery mechanisms to improve crop productivity, and it promises to reduce pesticide applications. Nanochemical engineering can increase agricultural production, and its applications include:

(1) Nano formulations of agrochemical engineering s for applying pesticides and fertilizers for crop improvement

(2) The application of nano chemical sensors in crop protection for the identification of diseases and residues of agrochemicals.

(3) Nano chemical devices for the genetic engineering of plants;

(4) Plant disease diagnostics.

(5) Animal health, animal breeding, poultry production

(6) Postharvest management. Precision farming techniques might be used to further improve the crop yields but not damage soil and water.

In addition, it can reduce nitrogen loss due to leaching and emissions, and soil microorganisms. Nanotechnology applications include nanochemical engineering particle-mediated gene or DNA transfer in plants for the development of insect-resistant varieties, food processing and storage and increased product shelf life. Nanochemical engineering may increase the development of biomass-to-fuel production. Experts feel that the potential benefits of nanochemical engineering for agriculture, food, fisheries and aquaculture need to be balanced against concerns for the soil, water and environment and the occupational health of workers. Nanochemical engineering uses are currently being researched, tested and in some cases already applied in food technology. Nano chemical engineering materials are considered with specific chemical, physical and mechanical properties. In recent years, agricultural waste products have attracted attention as source of renewable raw materials to be processed in substitution of several different applications as well as a raw material for nonmaterial production. Insecticide resistance is one of the best examples of evolution occurring on an ecological time scale. The study of insecticide resistance is needed, both because it leads to understanding mechanisms operating in real time and because of its economic importance. It has become in insects an increasing problem for agriculture and public health. Agricultural practices could include wide range of selective regimes. Nanochemical engineering applications are being tested in food technology and agriculture. The applications of nanochemical engineering in agriculture aim to reduce spraying of plant protection products and to increase plant yields. Nanochemical engineering means like nanocapsules and nanoparticles are examples of uses for the detection and treatment of diseases. Nanotechnology derived devices are also explored in the field of plant breeding and genetic transformation. The potential of nanotechnology in agriculture is large, but a few issues are still to be addressed as the risk assessment. In this respect, some nano chemical particle attractants are derived from biopolymers such as proteins and carbohydrates with low effect on human health and the environment. Nanotechnology has many uses in all stages of production, processing, storing, packaging and transport of agricultural products. Nanochemical engineering will revolutionize agriculture and food industry such as in case of farming techniques, enhancing the ability of plants to absorb nutrients, disease detection and control pests.

III. CONCLUSION

- Nanochemical engineering involves chemistry, physics, biology, mathematics economics& engineering to solve real world problems.
- A nanochemical engineer might specialize in chemicals manufacturing, advanced materials manufacturing, biomedical engineering, pharmaceuticals, renewable energy, or food processing.
- In technical writing of any kind one wants to use correct verb tense, write in third person, be clear but concise, revise and proofread, and practice good writing ethics.
- There are many education opportunities. Choose a college with accreditation. Colleges have many financial opportunities to help pay for one's education.
- Many chemical engineering projects are currently being researched to improve our lives and our environment.
- Careers in the nanochemical engineering field are numerous. One will have to decide what industry nanochemical engineers excites one the most and that will make a positive impact, and then learn everything one can can to succeed.

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