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NANOTECHNOLOGY IN MECHANICAL ENGINEERING

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ABSTRACT

We exist in a world of machines and the technical basis for these machines lies in the steam engine developed during the 1780s by James Watt. The concept of deriving useful mechanical work from new fuel such as wood, coal, oil, and now uranium was revolutionary. Watt also developed the slider-crank mechanism to convert reciprocating motion to circular motion. To improve on this beginning, basic engine, the people who followed Watt created the scientific discipline of thermodynamics and perfected power transmission through gears, cams, shafts, bearings, and mechanical seals. A new vocabulary involving heat, energy, force, and torque was born with the steam locomotive. Nano technology will extend the capabilities of engineers and enable more complex designs to be dispatched anywhere.

Keywords: *Nanotechnology, mechanical engineering, nanomaterials, nanoscale devices*

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Introduction

The nanomaterials field includes subfields which develop or study materials having unique properties arising from their nanoscale dimensions. Interface and colloid science have given boost to many fabrics which may be useful in nanotechnology, such as carbon nanotubes and other fullerenes, and various nanoparticles and nanorods. Nano-materials with fast ion transport are related also to nanoionics and nanoelectronics. Nanoscale materials can also be utilized for bulk applications; most present commercial applications of nanotechnology are of this flavor. Progress has been gained in employing these textiles for medical applications. Nanoscale materials are sometimes employed in solar cells, which combats the cost of traditional Silicon solar cells.

Development of applications incorporating semiconductor nano-particles to be used in the next generation of products, such as display technology, lighting, solar cells and biological imaging; see quantum dots.

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Experimental:

Nanotechnology Research In Mechanical Engineering.

Even more significant may be nanoscale machines, devices that function at molecular or even atomic scales. Some pioneers in the field envision the day when nanoscopic robotic submarines will kill off cancers one cell at a time, and foresee nano- scale factories in which tiny arms piece together products molecule by atom. Already, research has demonstrated that the flow around microscale devices is usually laminar and inertial forces are modest in comparison with viscous forces. Except for hydrodynamic lubrication, such a situation rarely occurs in macrodevices.

NanoscaleThermal-Electrical Transport:

The interplay between thermal and electrical energy at small scales can strongly influence the functional behaviour of many types of devices such as direct energy conversion elements, heat sinks, and field-effect transistors. Inquiry at the Nanoscale Thermo-Fluids Lab seeks to speak these events by studying novel nanomaterials, especially carbon nanotubes, both from the perspective of material synthesis and characterization and from the perspective of functional engineering performance. The laboratory's activities include detailed experimental and computational studies synthesis by plasma-enhanced chemical vapor deposition with applications to single-wall carbon nanotube transistors, and multi-wall carbon nanotubes arrays used to enhance thermal/electrical interface conductance, boiling heat transfer, and biosensor performance. Farther, the laboratory has developed unique capabilities to measure and model thermal-electrical energy, transport and conversion from nanoscale electron emitters.

Thermal Micro/Nanosystems:

Thermal transfer is getting increasingly vital in the invention and performance of micro-and nano-systems. Inquiry in this region includes the development of a range of micropumping approaches and high-resolution measurement techniques. Example tasks include the evolution of a micromechanical electrohydrodynamics (MEHD) based liquid pump with multiple driving mechanisms to deliver high flow rates, and an ionic wind-driven heat transfer enhancement scheme. Other fields of research include microscale actuation of liquids using electrowetting and dielectrophoresis, thin film evaporation, single and two-phase microchannel transport and evolution of carbon nanotube-based heat spreaders.

Nano Thermo-Physical Engineering:

The behavior of any physical system can be connected to the atomic - scale description. With an atomic level knowledge of the energy carrier (photon, electron, phoning, and fluid particle) characteristics and behaviors, one is able to prompt upwards to design nano- and micro-structures with the desired size effects, or to synthesize new materials with the desired parts. Research at the Nano Thermo-Physical, Engineering Lab seeks to build and expand the understanding of the fundamentals of atomic-level carrier transport and interactions, and to apply this knowledge to important energy and information technologies. Current projects include the applied science of electron-phonon coupling in quantum dot solar cells, enhanced laser cooling of semiconductors and ion-doped solids, controlled thermal emission using modulated micro- and nano-structures, thermo-optical management of nano-lasers, and so on

Advanced Micro& Nano-mechanical Materials and Process Technologies

Now- a- days material selection capability in micro/nano systems, applications has been relatively limited, due primarily to the predominance of micro fabrication processes and infrastructure dedicated to silicon. While silicon has proven to be an excellent material for many applications, no single material can match the demands of whole applications. Research in this area, therefore, seeks to get the materials and process technologies needed for realization of applications that are either impractical or impossible using conventional silicon-based micromachining, e.g. biomedical and harsh environment applications. Areas of specific interest in this context that are presently under development include anisotropic titanium micromachining, micromechanical composites, and novel applications thereof.

Nanomaterials In Mechanical Side

We can define nanomaterials as those which have nanostructured components with at (less than 100nm). Materials with one dimension in the nanoscale are layers, such as a thin films or surface coatings. Fabrics that are nanoscale in two dimensions are nanowires and nanotubes. Materials that are nanoscale in three dimensions are particles, quantum dots (tiny specks of semiconductor materials). Nanocrystalline materials, prepared up of nanometer-sized textures, also fall into this class.

Two main factors have the properties of nanomaterials to differ significantly from other materials: increased

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relative surface area, and quantum effects. These genes can modify or enhance properties such as responsiveness, strength and electrical properties, optical characteristics.

Latest Development In Nanotechnology From Mechanical Side

Recent Developments in Using Nanotechnology to Manage the Corrosion of Steel:

Over the last two decades, significant advancements have been made to improve the management of steel corrosion through research, development, and implementation; and nanotechnology has been playing an increasing important role in supporting innovative technological advances.

Nano technology has been used to heighten the inherent corrosion resistance and carrying out of the sword itself, by reaching the desirable finely crystalline microstructure of steel (e.g., nana-crystallization) or by changing its chemical composition at the nanometer scale (e.g., formation of copper nano particles at the steel grain boundaries). Metallurgy approaches to the production of high-performance steel with a fine-grain construction and/or self-organization of strengthening nano phases (carbides, nitrides, carbon nitrides, inter metallides) have been burgeoning under the guidance of nanotechnological principles, including nanoprocesses for steel smelting and microalloying, mechanical pressure treatment (e.g., intense plastic deformation), and high temperature treatment (e.g., super fast quenching of molten).

Nanotechnology has been used to thin out the impact of corrosive environments through the alternation of the steel/electrolyte interface (e.g., formation of nanocomposite thin film coatings on steel). Substantial advances in the corrosion protection of steel have been reported through the co-deposition of Ni-SiC or Ni-Al2O3 nanocomposite coatings on mild steel and the application of TiO2-naoparticle sol-gel coatings or multilayer polyelectrolyte nanofilms on 316L stainless steel. The incorporation of nano-sized molecules (e.g., polyaniline/ferrite, ZnO, Fe2O3, halloysite clay, and other nanoparticles) into conventional polymer coatings also significantly raised the anti-corrosive performance of such coatings on steel substrates. Incorporation of nanoparticles in ceramic coatings, polymer coatings, and hybrid sol-gel systems for improved properties (e.g., resistance to corrosion and high-temperature oxidation, self-cleaning, and anti-fouling)

Results And Discussions:

Current and Future Development

Nanotechnology has shown its clear benefits and will continue to take on a central part in the production of high-performance steel. Future developments will be concentrated on encouraging the understanding of why and how superior corrosion resistance (as comfortably as other desirable attributes) of steel can be achieved by the design and control of its chemical composition and morphology at the micro- and nanometer scales (e.g., through microalloying and thermal mechanical treatment). Progress in steel production technology will open the possibility of rapid change in steel metallurgy and increase the competitiveness of nano-enabled products.

Nanotechnology has made for fundamental changes to the methods of mitigating corrosion risk at the steel/electrolyte interface. Future developments will go forward in technologies that can produce an ultra thin ceramic or a metallic nano composite layer or nano crystalline layer on steel (e.g., physical vapor deposition, chemical vapor deposition, ion implantation, sol-gel applications, and electro deposition). More innovation can also be required in the incorporation of nano particles in ceramic coatings, polymer coatings, and hybrid sol-gel systems for enhanced corrosion protection of blade and other metallic substrates. The author trusts that in the coming years much more attention will be paid for the usage of nanotechnology in intelligent corrosion protection systems. One new area of application would be the role of nano-sized reservoirs in self-healing coatings, even though current research has been confined to micro-sized capsules. Another increasingly active field would be the use of functionalized nanoparticles as an innovative carrier of corrosion inhibitors in coatings since nano particles feature high surface area and can be engineered for smart delivery of corrosion inhibitors.

Conclusion:

Mechanical engineers over the succeeding two decades will be called upon to produce technologies that foster a fairer, healthier, more dependable and sustainable global environment". The nanotechnology will dominate technological development in the next 20 years and will be integrated into all aspects of technology that involve our spirits on a daily base. Nanotechnologies will provide the building blocks that future engineers will practice to resolve pressing problems in various areas including medicine, energy, water management, aeronautics, farming and environmental management. Equally it is turning more and more obvious that the nanotechnologies lie at the center of technological invention, many of the greatest opportunities for mechanical engineers lie in the crossroad of this technology. Mechanical engineering will turn the field to

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draw into the world in a safer position.

References:

1. *Engineering "mechanical engineering. (n.d.)". The American Heritage Dictionary of the English Language, Fourth Edition. Retrieved: May 8, 2010.*
2. *"Heron of Alexandria". Encyclopedia Britannica 2010 - Encyclopedia Britannica Online. Accessed: 09 May 2010.*
3. *Needham, Joseph (1986). Science and Civilization in China: Volume 4. Taipei: Caves Books, Ltd.*
4. *Al-Jazarí. The Book of Knowledge of Ingenious Mechanical Devices: Kitáb fí ma'rifat al-hiyal al-handasiyya. Springer, 1973. ISBN 90-277-0329-9.*
5. *Engineering - Encyclopædia Britannica, accessed 06 May 2008*
6. *R. A. Buchanan. The Economic History Review, New Series, Vol. 38, No. 1 (Feb., 1985), pp. 42–60.*
7. *The Columbia Encyclopedia, Sixth Edition. 2001-07, engineering, accessed 06 May 2008*
8. *"Mechanical Engineering". Retrieved 8 December 2011.*
9. *ABET searchable database of accredited engineering programs, Accessed June 19, 2006.*
10. *Accredited engineering programs in Canada by the Canadian Council of Professional Engineers, Accessed April 18, 2007.*

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