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INNOVATIVE TRENDS AND ASPECT OF GREEN NANO-TECHNOLOGY DEVELOPMENT CHALLENGES AND OPPORTUNITIES

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***Abstract*— This paper represent the innovative trends and aspect of green nanotechnology development challenges and opportunities in the field of alternative technology to assist in future developments in this field. There are various innovative applications of green Nano-technology in different- different fields like Energy, Medicine and Drugs, Nano bio-technology, Nano devices, Optical Engineering, Defence & Security, Bio Engineering,Cosmetics,Nano Fabrics etc. Nanotechnology improves the process of production and also improves the quality of products. It works at the molecular level and utilizes the more advanced concept, idea and research for the development of different fields and production.**

***Index Terms*— Green Nano Science, Carbon Nanotubes (CNT), Single-walled Carbon Nano Tubes (SWCNT),Multi-walled Carbon Nano Tubes (MWCNT),Nano chemistry, Green engineering, Green technology, TIM (Thermal Interface Materials).**

I. INTRODUCTION.

Green engineering is the design, commercialisation and use of processes and products that are feasible and economical while:

Reducing the generation of pollution at the source, minimizing the risk to human health and the environment [1]. Nanotechnology improves the quality of process which leads to the development of different fields. A huge amount of research and development activity has been devoted to Nano-scale related technologies in recent years. The National Science Foundation projects nanotechnology related products will become a $1 trillion industry by 2015[2.]. The concept of using Nano-fluids as a means of improving coolant performance was proposed over a decade ago[3]. Reports of up to 100% increase in liquid thermal conductivity with the addition of nanometre scale particles motivated a large amount of scientific/technical inquiry in the ensuing years

Figure 1.Application of nanotechnology

II. THE ROLE OF MECHANICAL ENGINEERING IN NANOTECHNOLOGY

There is a very big role of mechanical engineering in nanotechnology as mechanical have developed so many useful instruments like Nano indenters and atomic force microscopes for the mechanical testing, Nano scale imaging and for precision measurement.

Mixtures of Nano- and micro- scale particles add another dimension for controlling thermal, rheological and mechanical properties [5].Of particular interest is the use of carbon Nano-tubes for TIM (Thermal Interface Materials) applications. The CNT is essentially a single atomic layer of graphite (graphene) which is rolled up onto itself. There are single- and multi-walled versions of CNT which can exhibit thermal conductivity in excess of 1000 Watts/meter ° Kelvin (for comparison, Cu = 400W/mK) and high tensile strength along the axis of the tube. Applications to TIM have involved two basic approaches:

Simple addition of CNT to the TIM matrix (grease, gel,etc.)& Growth of vertically aligned CNT 'carpets' on the heat sink or device package.

In the former approach, CNT loading is increased until percolation of fibres provides a thermal path from mating surfaces. In the latter growth method, the individual CNT provide a direct high-conduction path between surfaces [5,6].

Research has shown that optimal particle loading achieves improved thermal conductivity and low modulus (to accommodate thermal expansion mis match of components) with a variety of materials and particles hopes/sizes [7].

III. FUEL AND NANOTECHNOLOGY

Nanotechnology can address the shortage of fossil fuels such as diesel and gasoline as it-

Making the production of fuels from low grade raw materials economical, It increasing the mileage of engines, and it also make the production of fuels from normal raw materials more efficient [1].Since nanotechnology also deals with the fuels and making the production of fuel economical by utilizing the modern concept, current works and development of green nanotechnology.

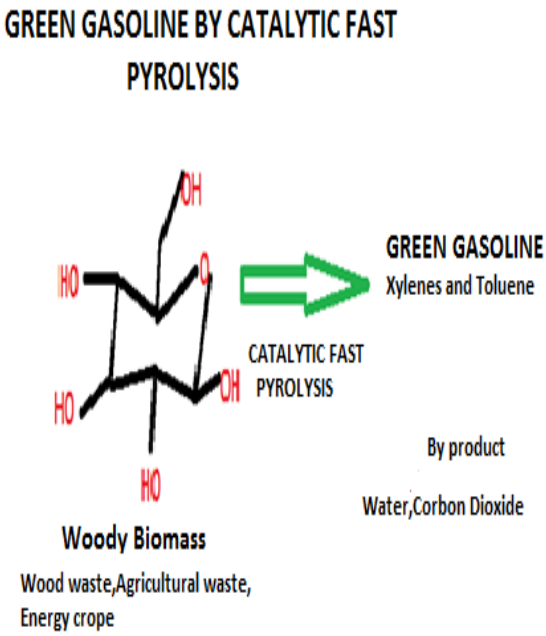

Figure.2 Green gasoline by catalytic fast pyrolysis

The above figure shows that how low grade material like woody biomass is being used for making green gasoline by catalytic fast pyrolysis process which makes the production of fuel economical.

IV. NANO-TECHNOLOGY APPLIED TO SOLDERING SYSTEM

The industry has developed new solder alloys to replace SnPb eutectic alloys, but the required processing temperature must increase by about 35°C to accommodate the alloy (tin silver copper family, SAC). This increase in processing temperatures to about 235°C to 245°C, results in additional unwanted thermal stress on the electronic components being assembled as compared to tin-lead assembly temperatures of about 210°C.Research is being conducted in the realm of Nano-particle sized solder alloys. Metals undergo a melting point depression when the particle size is reduced to Nano-scale. Preliminary work by an iNEMI Nano Solder Project Team [8] has worked towards demonstrating that a reduction in melting temperature of a solder alloy is feasible as a function of particle size.

V. ENVIRONMENTAL HEALTH & SAFETY

A critical feature of nanoparticles is their high surface-area to-mass ratio. This property provides additional sites for bonding or reaction with surrounding material and results in unique characteristics such as improved strength or heat resistance. Similarly, evidence suggests that when in haled ,the large surface area of insoluble nanoparticles creates the potential for greater biological activity [9,10,11].Although dependent upon their effective size in the body and other physio-chemical characteristics, studies have also shown that when nanoparticles are inhaled they may penetrate cell swallowing direct access to the bloodstream and possibly circumventing the blood-brain barrier or depositing in other organs of the body [12,13].

Several studies have noted an increased risk of biological responses from exposure to carbon Nano-tubes [14, 15, 16, 17].

Both single-walled (SWCNT) and multi-walled (MWCNT) carbon Nano-tubes are non-biodegradable and resemble needle-like, carcinogenic asbestos fibres in size, shape and cellular persistence. Until recently several studies only suggested a potential link between inhalation exposure to long MWCNTs and cancer, but had not demonstrated that inhaled MWCNTs could actually pass from the lung and into the surrounding tissues [18, 19, 20].

Green Nanotechnology is an interdisciplinary rapidly developing knowledge base at the interface of agriculture, chemistry ,physics ,medical sciences etc.[21].

The National Institute for Occupational Safety and Health (NIOSH) researchers have reported new data showing that MWCNTs can indeed migrate intact from the lungs of mice and into the tissue surrounding the lungs where asbestos induces a form of cancer known as mesothelioma [22].Significant absorption of Nano-material through the skin appears unlikely. Passive diffusion appears to be the primary mechanism for transport across the stratum corneum. The composition of this outer layer of the skin creates an effective barrier to dermal absorption of both chemicals. Although some studies have indicated that penetration of particles in low micron diameter size range is possible, penetration is likely to be slow and not present an acute hazard [23].

VI. CHALLENGES AND OPPORTUNITY

Nanotechnology, as an emerging technology, presents an important opportunity scientific and business community. Nanotech is unlike some other sectors of the chemical industry, where significant capital is already invested in the form of large plants and established supply chains in which production techniques are technologically and culturally embedded. In fact, the need to develop both new Nano products and their equally novel production techniques presents an important opportunity for innovators. In this case, there

is an unusual opportunity to use science, engineering and policy knowledge to design novel products that are benign as possible to human and environmental health. Recognition of this opportunity has led to development of "Green Nano science" concept [24,25].

VII. CONCLUSIONS

By the development and implementation of nanotechnology, the automobiles industries growth will be influenced and will use the innovative application of the green nanotechnology which is suitable for human health and environment .Metal nanoparticles are being considered for potential use in catalytic converters since the catalytic reactivity is significantly enhanced due to the increased surface area of the metal. Coolants utilize nanoparticles and Nano-powders to increase the efficiency of heat transfer and potentially reduce the size of the automotive cooling equipment. Some manufacturers are currently using Nano-magnetic fluids in shock absorbers to increase vibration control efficiency. Nanotechnology will influence the auto industry initially on a very small scale, but will certainly be developed to deliver features, products and processes that are almost unimaginable today.will be influenced and will use the innovative application of the green nanotechnology which is suitable for human health and environment .Metal nanoparticles are being considered for potential use in catalytic converters since the catalytic reactivity is significantly enhanced due to the increased surface area of the metal. Coolants utilize nanoparticles and Nano-powders to increase the efficiency of heat transfer and potentially reduce the size of the automotive cooling equipment. Some manufacturers are currently using Nano-magnetic fluids in shock absorbers to increase vibration control efficiency. Nanotechnology will influence the auto industry initially on a very small scale, but will certainly be developed to deliver features, products and processes that are almost unimaginable today.

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