



## NANOMATERIAL A FUTURE PROMISING MATERIAL

*Kalpana G. Joshi<sup>1\*</sup>, S. B. Bajaj<sup>2</sup>, Sumedh S. Ingle<sup>3</sup>*

<sup>1</sup>Research Scholar, JES College, Jalna, BAMU, Aurangabad, India,

<sup>2</sup>Associate Professor, Department of Physics, JES College, Jalna, India

<sup>3</sup> Associate Professor, Department of Mechanical Engineering, SRES, College of Engineering, Kopargaon-423603, India

\*kalpanagjoshi@gmail.com

**Abstract :** Global warming is a recent burning issue all over the world, cause due to pollutants in environment. To cope up with Global warming, nanotechnology concept can be used. Nanotechnology is a multidisciplinary area of applied science and Engineering that deals with design and manufacture of extremely small components. By research, it is found that using nanomaterials in various applications, it is possible to get enhanced performances. In this present work we emphasize on use of nanomaterials in various applications which helps to reduce the pollution and performance of various devices. Also application of nanotechnology in medical field is elaborated to improve diagnosis, treatment and drug delivery.

**Keywords:** nanomaterials, carbon nanotube, catalyst, quantum dots etc.

### 1. INTRODUCTION

The mankind has seen several technology revolutions in the past: industrial, agricultural, medical, and InfoTech in a course of two centuries. But through each of these, we have been able to exploit only a small fraction of the total possibilities. Nanoparticles made of metals, semiconductors, or oxides are of particular interest for their mechanical, electrical, magnetic, optical, chemical and other properties.

Nanoparticles often have unexpected visual properties because they are small enough to confine their electrons and produce quantum effects. They consist of very high surface area to volume ratio of nanoparticles which provides a tremendous driving force for diffusion, especially at elevated

temperatures. The Present research work focuses on application of nanomaterials in concern to health and environment.

### 2. APPLICATIONS OF NANOTECHNOLOGY

Nanotechnology is having tremendous applications in various fields because of the change in properties of materials at nano level. A bulk material should have constant physical properties regardless of its size, but As materials reduced to the nanoscale can suddenly show very different properties compared to what they exhibit on a macroscale, enabling unique applications. Few applications are discussed below.

#### 2.1 NANOTECHNOLOGY IN AUTOMOBILES

Nanotechnology will help automotive manufacturers make the paint last longer, decrease the rust factor, make windows easier to clean, make stronger tires, and make bodies lighter weight and thus, more fuel efficient [2].

### **2.1.1. NANOTECHNOLOGY KEEPS PAINT JOB SHINY**

Nanotechnology could help to come out of big scratch in the paint job, because several companies are producing scratch-resistant products that could be built into car's paint job or applied aftermarket. These products use nanoparticles that form chemical bonds to the car surface, creating a longer-lasting coating. One company, PPG, produces a scratch-resistant clearcoat called CeramiClear that helps a car's paint stay glossy longer. It contains nanoparticles that bead on the surface and produce the longer-lasting shine. In addition to the gloss, CeramiClear protects the paint from chipping by producing a surface similar to silica (glass).

### **2.1.2. NANOTECH TIRES TO GET A GRIP**

As it is said that a car is only as good as its tires. So what is nanotechnology doing to improve tires? Nanoparticles can be used to bond the various substances in the tread, strengthening the material. A company called Yokohama has developed a tire called ADVAN Sport that uses a nanotechnology-enabled tread compound to help the tires grip the road. This tire is intended to provide higher performance than most of us will ever need.

### **2.1.3. NANOTECH MAKES CAR WINDOWS EASIER TO CLEAN**

As there is a big problem of windows of car to clean due to dust particles and bugs etc to remove. Nano-based coating on window glass, allows only minimal contact with the things it encounters, from bugs and dirt to ice. By using nanomaterial treatment, repel most of the water and oils that assault on windshield and the wind

whipping around car would blow away the rest. This type of coating uses nanoparticles containing atoms on one end that form chemical bonds to the glass, and atoms on the other end that are hydrophobic (that is, they repel water) [6].

A company called Nanofilm makes Clarity Defender Automotive Windshield Treatment. This thin film can be used on both mirrors and glass in car. It produces a nanoscale barrier to water, snow, ice, as well as those nasty bug splats. One of the claims of this company is that the film helps to increase a driver's visibility, improving response times to road dangers.

### **2.1.4. NANOTECHNOLOGY MAKES CARS LIGHT WEIGHT**

Various car manufacturers are researching the possibility of using nanocomposites to create strong, lightweight materials that can be used in a car body to reduce the weight of the car. These materials combine nanoparticles with polymers to create lightweight materials as strong as steel. Researchers developing the material which is scratch-resistant, lightweight, and rust-proof. It also makes car bodies stronger and lighter weight, which translates into a longer car life span and savings at the gas pump, respectively.

### **2.1.5. NANOTECHNOLOGY IN CATALYTIC CONVERTER**

Internal combustion engine generates undesirable emissions during the combustion process. The major causes for these emissions are non-stoichiometric combustion, dissociation of nitrogen and impurities in the fuel and air. The exhaust gas sent into atmosphere by the engine contains hydrocarbon (HC), carbon monoxide (CO) and nitrogen oxide (NO<sub>x</sub>) for air pollution. These pollutants are known to cause global warming, acid rain, respiratory and other health hazards [1].

It is observed that emissions of harmful pollutants (NO<sub>x</sub>, CO and HC), reduces drastically

with catalytic converter having coating of Nickel Oxide nanomaterial as compare to catalytic converter without coating as shown in fig.1, fig.2, fig.3. The development of copper plate catalytic converter with coating of Nano-material is feasible, since it give's satisfactory results for operating conditions & reduction of HC, CO, NO<sub>x</sub>. The copper based catalyst system with coating can be effective approach in place of without coating of Nano-material based catalytic converter [7, 9, 12].

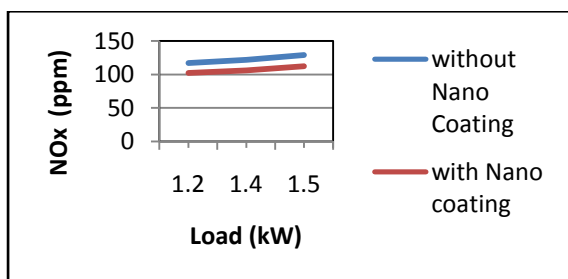


Fig.1. Graph of NOx vs Load

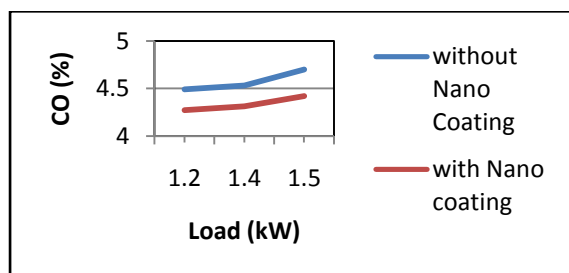


Fig.2. Graph of CO vs Load

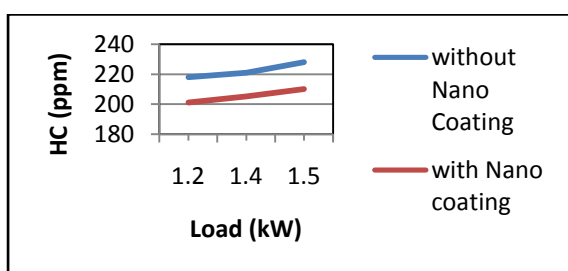


Fig.3. Graph of HC vs Load

2.1.6. NANOTECHNOLOGY IN BIODIESEL

Bio-diesel is a future fuel for diesel engine. With petro- products becoming increasingly polluting and harmful to environment there is need for alternative sources of energy. In the current scenario exploring energy alternatives in the form of bio fuels namely ethanol and Bio-diesel assumes top

priority. Bio-diesel derived from the plants like sun flower, rape seed canola or *Jatropha Curcas* can be used as a substitute to diesel. By using nanomaterials as fuel additive the emission reduces to considerable extent [3].

Biodiesel will soon replace petrodiesel because of its advantages. It opens lucrative markets to farmers. It will change the current scenario of energy dependence. It can converts thousands of hectares of wasteland for plants from which biodiesel can be obtained. When planted on either side of railway tracks and roads increases greenery. It provides employment. It provides healthier environment [4,5]. From fig.4. and fig.5. it is found that nanomaterial as a additive in diesel engine with biodiesel as a fuel gives less emission as compare to biodiesel without additive [11].

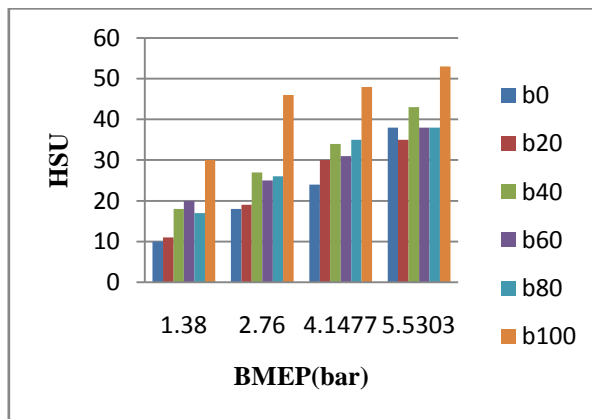


Fig.4. Smoke Density vs BMEP for Biodiesel

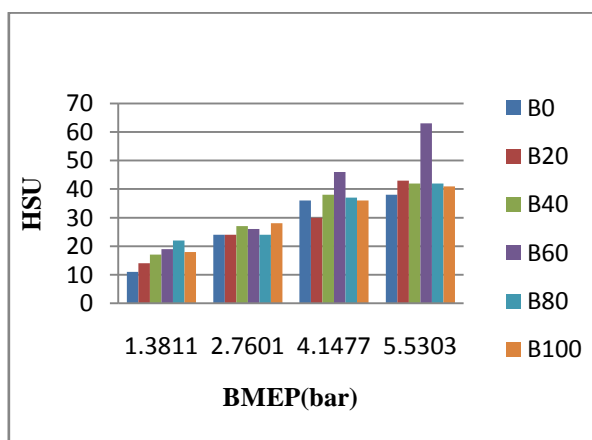


Fig. 5. Smoke Density vs BMEP for Biodiesel with additive

## 2.2 NANOTECHNOLOGY AND ENVIRONMENT

Nanotechnology is being used in several applications to improve the environment. This includes cleaning up existing pollution, improving manufacturing methods to reduce the generation of new pollution, and making alternative energy sources more cost effective. Potential applications include [10]

### 2.2.1 CLEANING UP ORGANIC CHEMICALS POLLUTING GROUNDWATER

Researchers have shown that iron nanoparticles can be effective in cleaning up organic solvents that are polluting groundwater. The iron nanoparticles disperse throughout the body of water and decompose the organic solvent in place. This method can be more effective and cost significantly less than treatment methods that require the water to be pumped out of the ground.

### 2.2.2. GENERATING LESS POLLUTION DURING THE MANUFACTURE OF MATERIALS

Researchers have demonstrated that the use of silver nanoclusters as catalysis can significantly reduce the polluting byproducts generated in the process used to manufacture propylene oxide. Propylene oxide is used to produce common materials such as plastics, paint, detergents and brake fluid.

### 2.2.3. INCREASING THE ELECTRICITY GENERATED BY WINDMILLS

Epoxy containing carbon nanotubes is being used to make windmill blades. The resulting blades are stronger and lower weight and therefore the amount of electricity generated by each windmill is greater.

### 2.2.4. PRODUCING SOLAR CELLS

Solar cell generate electricity at a competitive cost. Researchers have demonstrated that an array silicon nanowires embedded in a

polymer results in low-cost but high-efficiency solar cells. This may result in solar cells that generate electricity as cost effectively as coal or oil [10].

## 2.3 NANOTECHNOLOGY IN MEDICINE

One application of nanotechnology in medicine currently being developed involves employing nanoparticles to deliver drugs, heat, light or other substances to specific types of cells, such as cancer cells. Particles are engineered so that they are attracted to diseased cells, which allow direct treatment of those cells. This technique reduces damage to healthy cells in the body and allows for earlier detection of disease. For example, nanoparticles that deliver chemotherapy drugs directly to cancer cells are under development [8].

### 2.3.1. EARLIER DETECTION

We know that the earlier a disease can be detected, the easier it is to remedy. To achieve this, research is focusing on introducing into the body specially designed nanoparticles. These nanoparticles are composed of tiny fluorescent 'quantum dots' that are 'bound' to targeting antibodies. In turn, these antibodies bind to diseased cells. When this happens, the quantum dots fluoresce brightly. This fluorescence can be picked up by new, specially developed, advanced imaging systems, enabling the accurate pinpointing of a disease even at a very early stage.

### 2.3.2. FASTER DIAGNOSYS

Nanotechnology is also leading to faster diagnosis. Diagnosis can be a lengthy and stressful business, usually with a test sample having to be sent away for analysis. The results can take several days or even weeks to arrive. Nanotechnology is enabling much faster and more precise diagnosis, as many tests can be built into a single, often palm-sized device that only requires tiny quantities of sample. This device is sometimes called a 'lab-on-a-chip', and samples can be processed and analysed so

rapidly that the results can be read out almost instantaneously.

### 2.3.3. TARGETED DRUG DELIVERY

People often complain that the cure for a disease can feel almost as bad as the disease itself, as prescription drugs may have unpleasant side effects. This is because the body needs to be flooded with very high doses of a drug in order to ensure that a sufficient volume reaches the site of the disease.

Accurate targeting of the drug can now be achieved, using specially designed drug-carrying nanoparticles. This also means that much smaller quantities of a drug are necessary, reducing toxicity to the body. The drug is then activated only at the disease site (such as a tumour) by light or other means, and the progress of the cure can also be monitored using advanced imaging techniques [8].

### 3. CONCLUSION

Nanotechnology with all its challenges & opportunities is an unavoidable part of our future. It can be rightly said that nanotechnology slowly & steadily assuring in next industrial revolution. By using nanomaterials instead of bulk materials it is possible to reduce pollution by controlling emission from exhaust of engine & also in medical field to improve the recovery, diagnosis & treatment of various diseases.

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