CHAPTER: 13

NANOPARTICLES IN AUTOMOBILE

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INTRODUCTION

How Can Nanomaterials Help the Automotive Industry Push the Boundaries?

Quantum effects can drastically influence the characteristics of materials in structures smaller than 100 nm. It is possible to produce macroscopic materials with unique features and capabilities by manipulating feature size, chemical content, and atomic structures, enabling favorable new solutions in the automotive sector.

Nanotechnology is recognized as one of the key technologies that will keep the automotive industry competitive in the future. Fuel economy, environmental effect, safety, driver information, comfort, and alternatives to harmful and/or expensive materials are all hot themes in the car business.

In the automotive industry, nanomaterials provide benefits such as reduced weight, reduced friction and pollutants, reduced wear and corrosion resistance, UV resistance, and enhanced electronics and sensors.

According to a UN estimate, the number of vehicles on the road globally will double from 750 million today to almost 1.5 billion utility and passenger vehicles by 2030, thanks mostly to fast rising markets in China, India, Russia, Brazil, and South Africa. Throughout 50 million new automobiles are created each year around the world, which implies nanotechnology and its products have a big opportunity in the automotive industry.

Nanotechnology increases the performance of existing car technologies by improving the characteristics of materials. Figure 1 shows how nanotechnology is used in the automotive industry.

Carbon black and Nano oxides (silica, alumina) fillers, nano clay, carbon nanofibers (CNF), and graphene, as well as additional additives (Polyhedral Oligomeric Silsesquioxanes and nanostructured Poly(alkylbenzene)-Poly(diene)) are all found in automobile tyres (PAB-PDM). Nano-additives extend the life of tyres while also improving rolling resistance, abrasion resistance, and wet traction. Adding nanostructured materials to fluids, such as nanofibers, nanotubes, nanowires, nanorods, and nanosheets, results in a new class of nanofluids with better properties than traditional fluids. A variety of nanomaterials have been employed in automotive fluids, including nanostructured boric acid, tungsten nanospheres, copper nanoparticles, and graphene. Nanoparticles can increase the mechanical properties of fluid lubricants while also providing economic benefits.

Nano-enabled fabrics offer cutting-edge solutions for moisture absorption, dirt repellency, antibacterial and antistatic qualities, as well as wear resistance and noise reduction. Through design and production, the catalytic converter helps to minimize emissions from automobiles by substituting traditional metals such as cerium oxide and platinum. Ceramics with nano-sized rhodium and palladium are used in catalytic converters.

One of the emerging nanomagnetic materials revolutionizing vehicular computing systems is spintronics. To replace the current microsystem, several nanoparticles such as silicon, organic semiconductors, CNTs, and graphene are spin-injected into metals/oxides at an atomic level. Spintronics discusses how electric and magnetic fields can affect electrons and their rotations. They're used in energy recovery methods like braking energy reuse.

The flexible battery is another excellent application of nanotechnology. This battery is manufactured by simply covering a sheet of paper or plastic with an ink that contains CNTs and Ag nanowires. This battery is adaptable and simple to utilize in a variety of vehicle applications.

Nanomaterials are getting "commercial evaluation" as they continue to push the frontiers in the automotive sector, although slowly. Nanotechnology and nanomaterials have a promising future in the automotive sector due to various benefits such as reduced vehicle weight and hence increased fuel efficiency with lower emissions, increased product life, robustness, and efficacy.

OBJECTIVES FOR USING NANOTECHNOLOGY IN AUTOMOBILES

a) Environment

- Resource efficiency
- Catalysts
- Fuel cells

b) Comfort

- Product quality
- Ease of operation
- Passenger convenience

c) Safety

- Active safety
- Passive safety
- Easy maintenance

For the automotive industry, a comprehensive study of nanotechnologies' economic potential is required. Nanotechnology has the ability to expand the auto industry's market. Nanotechnology looks to provide a significant advantage. Nanotechnologies, with their wide range of applications and tremendous impact on materials and substances, could spur innovation, particularly in the automotive industry. Improved "material properties" and "surface functionalization" are followed by "protective and optical functions" in the field of chemistry and materials, which are used in vehicles. Obtaining a driving force can be used to improve industrial products through inventive research. These depict the automotive industry's distinguishing characteristics based on its technological capability. Nanotechnology is an add-on in the automotive sector for gaining a competitive advantage. Analysis of current advancements is required in order to determine the likelihood of future enhancements. Nanotechnologies play an important role in the automotive sector. "Electrochromic mirrors avoid driver blindness - anti-glare instruments and heat absorbing panes" are examples of nanomaterials. Treads constructed of nanomaterial composition cling better to various roads. In response to environmental cues, futuristic cars appear to be more intelligent. Nanotechnologies have important aesthetic and practical features. "Body-in-white, engine and chassis, lightweight construction composites" with new qualities that offer superior crash resistance can be researched for the vehicle. Nanotechnologies offer great optimization potential for drive units in terms of increased fuel economy and emission reduction. Catalytic converters are one application of nanotechnology. Because abrasion of parts affects the vehicle's operating properties, nano tribology may open up new possibilities. Nanotechnological items can be used to improve diffusion membranes. Nanotechnology applications have increased market rivalry and profitability in the automotive industry. When the automotive industry shares its knowledge and research with academic and research institutions, it can achieve incredible results in the realm of nanotechnology.

REFERENCES

1. *https://www.azonano.com/article.aspx?ArticleID=4936*
2. *https://iopscience.iop.org/article/10.1088/1757-899X/988/1/012070/pdf*