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"Nano particles in Automobile Tires"

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Abstract: *Need of mobility all across the world is increasing exponentially. This is also an important prerequisite for the progress of modern society. In the past, automobile has played a crucial role and shall continue to play a dominant role in the progress of society. The demand of automobiles is increasing rapidly especially in the countries like China, India, Brazil and Korea. The rising economies of these countries will further increase the demand of automobiles. In order to achieve safety, comfort and environment friendliness, automobile companies are investing heavily in research and development. In this context, nanotechnologies are likely to play an important role. Nanotechnology is opening new doors for innovative products and imaginative applications in automobile sector. This paper focuses and critically analyses the improvement in the tire quality and to increase the life of the tire by using nano materials in every layer of tyres*

Keywords: *Nano silica, Montmorillonite clay, Carbon nanotubes*

I. Introduction

Driven by a growing demand for fuel efficiency, combined with strict automotive standards for safety, durability and noise, as represented by the new EU tire label, automotive tyre manufacturers are continuously seeking to create better and more ecological tires. For decades, rubber fillers, like carbon black and silica as nano-structured materials, were the drivers of improvements in tires. Recently, the innovation trend is moving down the supply chain to the material suppliers, with new additives and nonmaterial's making their appearance, promising to expand further the 'magic triangle' of tires. Green tires have nowadays a market share of about 30% and the demand for tires of lower rolling resistance, lower weight and superior performance is likely to grow with the market uptake of electric cars. We are planning to add nanomaterial in all layers present in tire of an automobile thus to increase the life and to reduce the wear rate

II. Advancement or level of usage of nano particles in present tires

Different Nanoprene grades can be used to satisfy different requirement profiles for tyres (e.g. summer and winter tyres, green or high-performance tyres) and various tyre components (tread, side wall, carcass, etc.) in line with their glass transition temperature. Lanxess recently began commercial production of the material. Its first customer, Toyo Tire & Rubber, will use it in winter tyres

• **Nanobase**: a nano-molecular structure at the bottom of the strong cap of the tyre, improving grip and steering properties, while also reducing heat emission and therefore rolling resistance; used in the Nokian WR A3 tyre;

• **NanoPro-Tech** (Nanostructure-Oriented Properties Control Technology), a nano coating for the tyre tread, which reduces heat generation; used in the new Ecopia tyre range of Bridgestone;

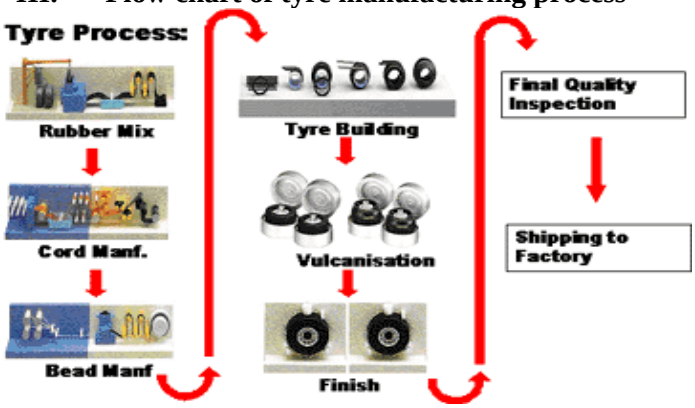
• **Tyres enhanced with CNT** (carbon nanotubes) appear to have improved mechanical properties, such as tensile strength, tear strength and hardness of the composites, by almost 600%, 250% and 70% respectively, comparing with those of the pure SBR composites (styrene-butadiene rubber)

• **A nanoclay containing BIMSM** (brominated isobutylene- co-para-methylstyrene elastomer),developed and commercialised by ExxonMobil, shows increased air retention properties that exceed those of halobutyl rubbers by about 50%;

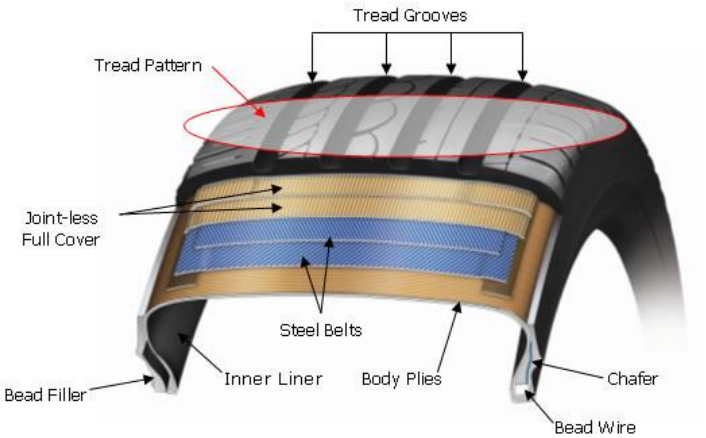
• **Lamellar nanomaterial organoclays** e.g. Montmorillonite Clay (MMT) developed by Pirelli give the tyre an isotropic behaviour (equal performance in longitudinal and lateral directions) and a better trade-off between handling and comfort, while also exhibiting higher stiffness, better thermoplastic stability and reduced decay;

• **Polyhedral Oligomeric Silsesquioxanes (POSS) ;**
• **Nano Oxides (Silica, Alumina) ;**
• **Carbon Nano Fibres (CNF) ;**
• **Graphene (delaminated Graphite) ;** and
• **Poly(alkylbenzene)-Poly(diene) (PAB-PDM) nanoparticles (polymer nano-strings)**

III. Flow chart of tyre manufacturing process



IV. Our new innovative methods



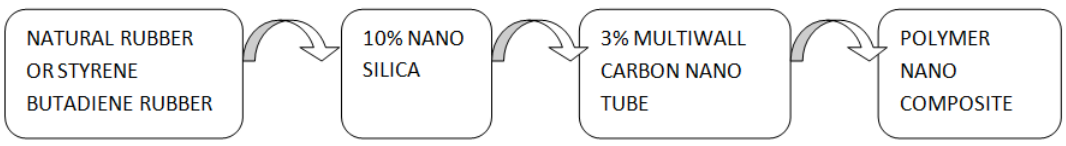
Scheme 1:

- The tread slab is placed on top of the belt system in the manufacturing process.
- The tread usually contains two rubber compounds:
  - The tread base compound adheres to the belt system when the tire is cured, is cooler running improving durability and helps stabilize the under tread area of the tire.
  - The tread cap is typically made with an abrasion resistant, higher grip rubber compound, which works with the tread base and tread design to provide traction and mileage.

Here to increase the wear resistance and grip NANOSILICA is added to the rubber

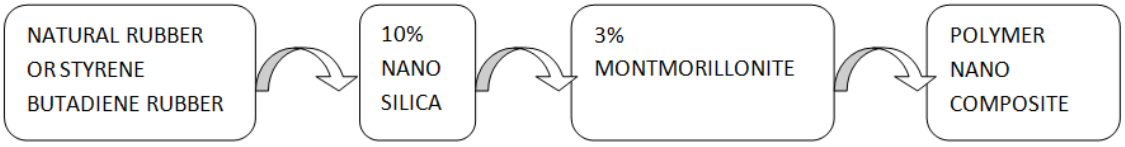
Polymer nano composites of natural rubber or styrene butadiene rubber (SBR) with 10% silicon dioxide (Nano silica) and 3% multiwall carbon nanotube

To increase the wear resistance and grip,10% silicon dioxide is added with SBR or natural rubber .To increase the tensile strength and hardness of the tire 3% mutiwalled nanotube is added to SBR or natural rubber .with these 10% silicon dioxide and 3% carbon nanotube we are going to get a new tire with improved properties. We are expecting the improvement by 600% in tensile strength , 250% in tear strength and 70% in hardness



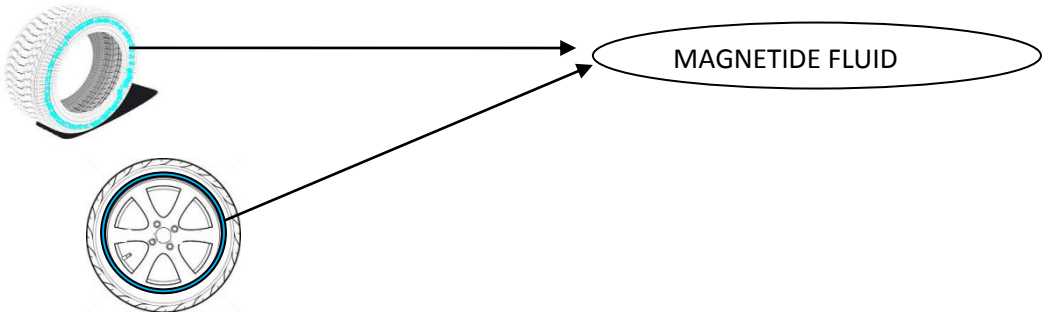
Scheme 2:

In this scheme 10% silicon dioxide and 3% montmorillonite clay is added to the natural rubber or (SBR).addition of this will give an isentropic behavior (I,e) equal performance in longitudinal and lateral directions and better trade off between handling and comfort, we are also improving the stiffness, thermoplastic stability and reduced decay. The nanosilica will improve the wear resistance and grip.

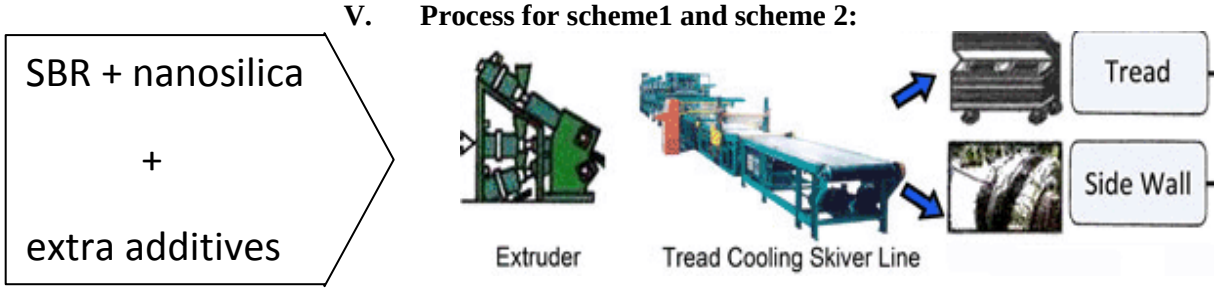


Scheme 3:

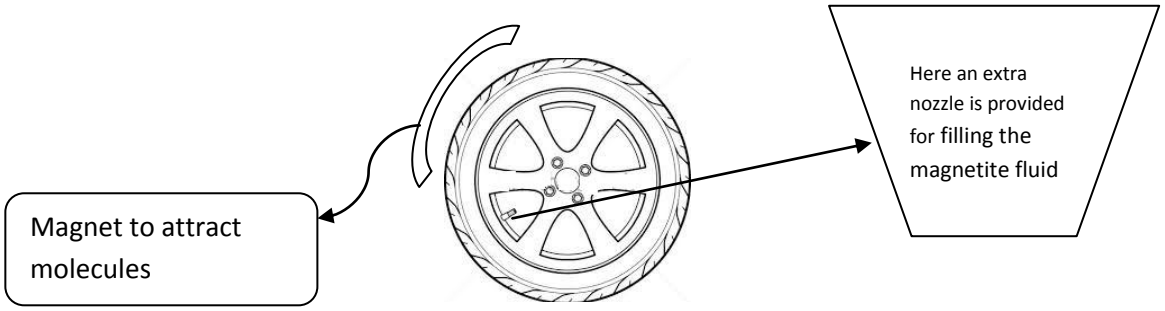
The system, which relies on slurry of tiny particles of magnetite, a form of iron oxide. Here the magnetite nanofluid flowed through tubes and was manipulated by magnets placed on the outside of the tubes.The magnets attract the particles closer to the heated surface of the tube, greatly enhancing the transfer of heat from the fluid, through the walls of the tube, and into the outside air. Without the magnets in place, the fluid behaves just like water, with no change in its cooling properties. But with the magnets, the heat transfer coefficient is higher



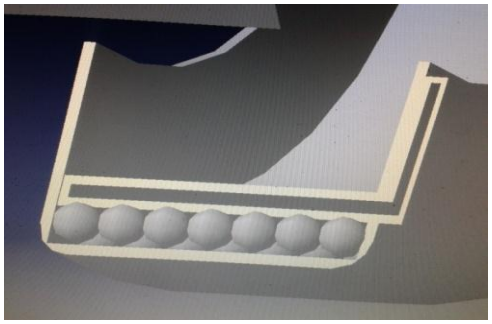
V. Process for scheme1 and scheme 2:

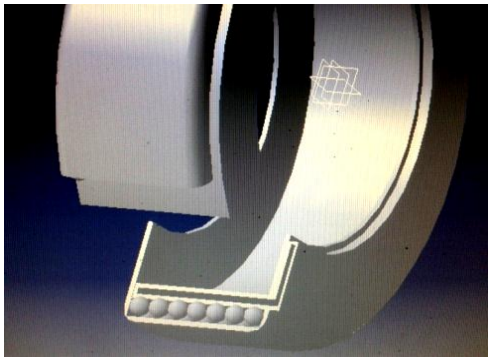


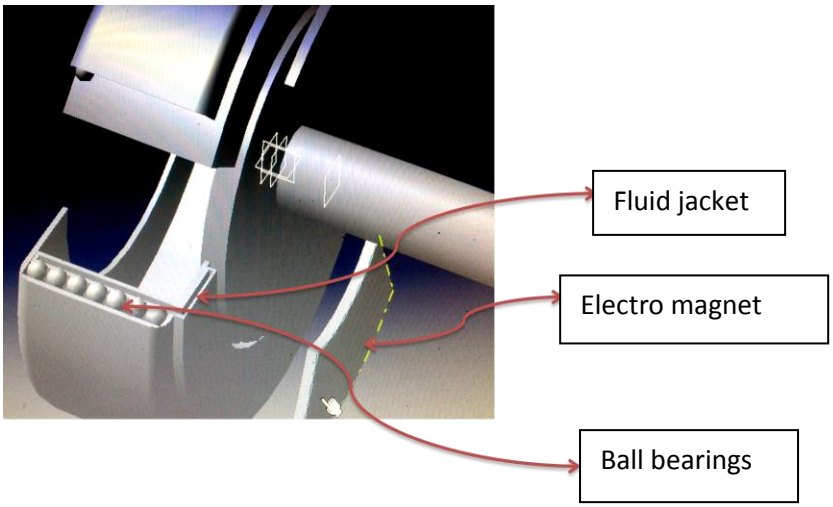
VI. Design for scheme 3:



Now with these improvements, it is going to be a better tyre in automobile industry







VII. Results

From scheme 1,2 and 3 we are going to light aplenty ways of reducing wear, cost and heat generated .here all the advantages and disadvantages are to be taken into issue and this new technology will be fabricated soon

VIII. Conclusion

For years now we have heard of how new technology to reduce the wear and cost in higher rates and percent am sure a lot of papers have been presented before and that has been a seed to what we see and use in today tyres.The next only step is to bring awareness to driving people to use these green nano tyres

Acknowledgement

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