

NANO COMPOSITE: - A review of various properties and new application opportunities

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ABSTRACT

Nano composite material are high performance material having unusual property combination and unique design possibilities with an high demand on estimated growth of 25% annually in engineering and their potential of being used in various areas from packaging to bio- medical applications. They are very useful. In this review paper we are going to discuss about various properties and new application opportunities of Nano composite materials. The objective of this research article is to evaluate the mechanical properties of nano composite material.

Keywords, nanocomposite material and bio medical applications.

Introduction

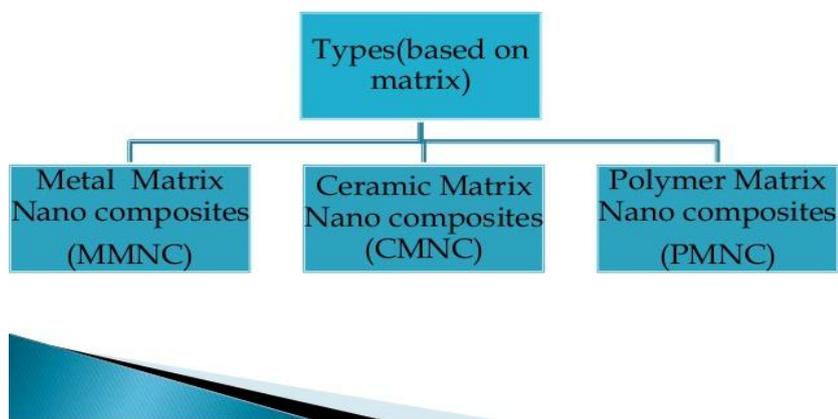
In the past few decades, composite material have been increasingly applied as structural material in aerospace, automotive and chemical industries, providing lower weight alternatives to traditional metallic material. Numerous these applications are concentrated on tribo-logical components, such as gears, cams, bearings and seals, etc. In previous years, nonmaterial science and technology have rapidly developed. Many researchers have found that a great variety of nano and micro- level inorganic reinforcements, such as nano- Si_3N_4 , ZnO , TiO_2 .

Composite materials made from two or more constituent materials with significantly different physical or chemical properties, that when combined, produce a material with characteristics different from the individual components. If the size of at least one of the component constituent is nano materic than the composite is nano composite.

A nano composite is a matrix to which nanoparticles have been added to improve a particular property of the material less than 100nanometers (nm), or structure having Nano scale repeat distances between the different

phases that make up the material. The properties of nanocomposite have caused researchers and companies to consider using this material in several fields.

Types of Nanocomposites^[9]



Properties of Nano composite materials

Tiny particles with very high aspect ratio, and hence larger surface area. Larger surface area enables better adhesion with the matrix/surface. Improvement in the mechanical performance of the parent material.

Multi-functionality, Why Nanocomposites?

Small filler size: High surface to volume ratio bulk interfacial material→Small distance between fillers
 Mechanical Properties Increased ductility with no decrease of strength, scratching resistance
 Optical properties Light transmission characteristics particle size dependent
 Traditional nanocomposite Stress polymer Strain.

Applications of nanocomposites:

Producing batteries with greater power output. Researchers have developed a method to make anodes for lithium ion batteries from a composite formed with silicon nanospheres and carbon nanoparticles.

The anodes made of the silicon-carbon nanocomposite make closer contact with the lithium electrolyte, which allows faster charging or discharging of power. Speeding up the healing process for broken bones. Researchers have shown that growth of replacement bone is speeded up when a nanotube-polymer nanocomposite is placed as a kind of scaffold which guides growth of replacement bone.

The researchers are conducting studies to better understand how this nanocomposite increases bone growth. Producing structural components with a high strength-to-weight ratio. For example an epoxy containing carbon nanotubes can be used to produce nanotube-polymer composite windmill blades. This results in a strong but lightweight blade, which makes longer windmill blades practical. These longer blades increase the amount of electricity generated by each windmill. Using nanocomposites to make flexible batteries. A nanocomposite of cellulosic materials and nanotubes could be used to make a conductive paper. When this conductive paper is soaked in an electrolyte, a flexible battery is formed.

Conclusion

Nano composite material gives high strength with less weight compared to conventional materials. These material have higher surface hardness and higher wear resistance when composites field with short carbon fibres, graphite etc. In different proportions and combinations.

References

- [1] M.H. Cho, S.Bahadur^{*}. Study of the tribological synergistic effects in nano CuO-filled and fiber-reinforced polyphenylene sulfide composites.
- [2] L.C Z hang^{*}, I.Zarudi, K.Q.Xiao. Noval behaviour of friction and wear of epoxy composites reinforced by carbon nanotubes .
- [3] B. Sursha^{a,*}, B.N Ravi Kumar^b, T.Jayaraju^a. Role of micro/nano fillers on mechanical and tribological properties of polyamide66/polypropylene composites.
- [4] Guo-ming Lin, Guang-you Xie, Guo-xie Sui^{*}, Rui Yang. Hybrid effect of nanoparticles with carbon fibers on the mechanical and wear properties of polymer composites.
- [5] Sirong Yu^{a,*}, Haixia Hu^a, Jun Ma^{b,**}, Jian Yin^c. Tribological properties of epoxy/rubber nanocomposites.
- [6] Gu Aj, Liang GZ. Thermal degradation behaviour and kinetic analysis of epoxy/montmorillonite nanocomposites.
- [7] S. Bhuyan, S.Sundararajan, D.Pfister, R.C. Larock. Effect of filler composition and crosslinker concentration on the tribological behaviour of spent germ particle-based polymeric composites.

[8] Guang Shi, Ming Qiu Zhang, Min Zhi Rong, Bernd Wetzel, Klaus Friedrich. Sliding wear behaviour of epoxy containing nano- AL_2O_3 particals with different pretretments.

[9] X.S. Xing, R.K.Y.Li. Wear behaviour of epoxy matrix composites filled with uniform sized sub-micro spherical silica particles.

[10] I.C Viscontl, A.Langella, M. Durante. The wear behaviour of composite materials with epoxy matrix filled with hard powder.