INVESTIGATION ON MECHANICAL AND TRIBOLOGICAL CHARACTERISTICS OF FIBER REINFORCED NANO HYBRID COMPOSITES FOR AGRICULTURAL APPLICATIONS

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Introduction :

A composite material is an auxiliary material that comprises more than two consolidated constituents that are joined at a plainly visible level and are not solvent to each other. One is known as the reinforcement and the other one in which it is implanted is known as the matrix. The reinforcement material might be as fillers, particles or fibers. The matrix materials are for the most part ceaseless. Cases of composite frameworks incorporate epoxy reinforced with carbon and Glass fibers etc, cement strengthened with steel. Advanced composites are composite materials that are generally utilized as a part of the aircraft industries.

Over the last 25 year's plastics, metals, ceramics and composite materials, have been the predominant rising materials. The number and volume of uses of composite materials have become reliable. Present day composites constitute a Silicon Carbide (Sic) degree of the fabricated materials market extending from regular items to advanced structural applications. While composite materials have authoritatively shown their quality as weight saving products, the current assessment is to make them financially safe. It is key that there be an incorporated effort in design, material, process, tooling, manufacturing, and even quality certification for composites to wind up forceful with metals. The composite industry has started to perceive that the business uses of composites guarantee to offer much greater business opportunities than the aviation area. In this way the development of composite applications from aerospace to other business utilizes has ended up noticeable in recent years.

Objectives

- To fabricate the Glass Carbon fabric-epoxy (G-C-E) composites with different loading of Titanium oxide (Ti02) micro particles by Hand layup technique.
- To design the Glass-Carbon epoxy composite materials filled with Titanium oxide (Ti02) as filler and to design the Glass-epoxy composite materials with fiber laminate orientation, after design parameters are selected.
- Characterization of mechanical properties, such as flexural strength, impact strength, flexural modulus, tensile strength, tensile modulus.
- To evaluate the tribological properties (wear rate) of Glass-Carbon filled with Titanium oxide (Ti02) composites and comparing it with those of unfilled plane Glass-Carbon composites.
- To understand the role of Titanium oxide (Ti02) filler under various sliding distances, speed, load, and different filler loading combinations.

Methodology :

The composite materials were produced using Carbon fiber, E-Glass fiber, and industrially accessible lapox epoxy (LY991) alongside (hardener) methylene dianiline, Titanium oxide (Ti02) powder was utilized as filler materials. Titanium oxide (Ti02) particles are usually utilized as filler. It is pigment white and it is well known for its hardness. Titanium oxide (Ti02) as reinforcement is enhanced strength, quality, fatigue resistance, wear resistance, dimensional stability and lesser thermal extension.

Carbon fibers or carbon fibers are fibers about 5 to 10 micrometers (0.00020–0.00039 in) in diameter and composed mostly of carbon atoms. Carbon fibers have several advantages: high stiffness, high tensile strength, high strength to weight ratio, high chemical resistance, high-temperature tolerance, and low thermal expansion. These properties have made carbon fiber very popular in aerospace, civil engineering, military, motorsports, and other competition sports. However, they are relatively expensive compared to similar fibers, such as glass fiber, basalt fibers, or plastic fibers.

Fabrication is defined as the process of converting raw materials into final products. In this, hand layup method is utilized for the fabrication of composite materials. Hand layup method is the simple technique of composite manufacturing. The structural necessity for this technique is also minimum. The handling stages are very simple. The wax is pasted on the upper and lower die plate.

Results and Conclusions :

The Glass and Carbon fiber filled with 12% of Titanium oxide (TI02) Nano particulates possesses good flexural strength and can withstand the strength up to 812 N/mm2.

These Glass-Carbon composite samples possess better tensile strength and can withstand the strength up to 610 N/mm2 .This may be due to complete filling of voids in the matrix by the Titanium oxide (TI02) Nano particulates .

Wear loss increases by increasing the sliding distance for all the specimens. However, A-B with 12% Titanium oxide (TI02) Nanoparticles showed better dry sliding wear resistance.

The Wear loss was very less in composites consisting 12% (TIO2), Nano particulates this is due to the good properties of filler agents.

Scope for future work :

- Here the fabrication can be done in the ratio 55:45 (fiber matrix).it can be change to 50:50, 60:40, 65:35.
- Possible replacement of different fibers and fillers for the fiber reinforced composites.
- Conducting the different tests (tensile, wear) for the specimens by subjecting to different curing methods like sea water, hot oven, silane treatment.
- Dry sliding wear test can be carried out by changing the surface roughness value of the disc used, or by changing some parameters like sliding distances, loads.
- Silane treatment can be done for the different type of fillers, which leads to formation of outer layer on the filler particles. So that it enhances the mechanical characterizations.
- Further, the particles size can be varied and testing can be carried out.