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Mechanical Characteristics and Degradation of Synthetic Polymers

Carvy Levert*

Department of Science, University of Dhaka, Dhaka, Bangladesh

Description

In industries, polymeric composites are frequently used. This is because composite materials offer a number of advantages. The advantages include reduced weight, improved mechanical properties, and high durability. The industries examined include aerospace, the military, the automotive industry, sports and leisure, and industrial construction. Materials are made up of two or more phases that are physically and chemically different from one another. A composite's different stages are separated by a number of interfaces. The material's structural and functional properties are enhanced by the combination. Numerous advantages of composite materials include their low weight, fatigue strength, and high resistance to corrosion. Composites are now widely used due to their numerous advantages. Aerospace, automotive, sports and leisure goods, the military, and biomedical applications all make use of composite materials. Composite materials consist of a matrix phase and a dispersion phase. The principal phase is the matrix phase, which is continuous. Together with the scattered phase, the matrix phase is in charge of holding the load. The dispersed phase, on the other hand, is embedded in the matrix and has a discontinuous nature.

The dispersion phase, also known as reinforcement, is the secondary phase. The scattering stage is typically more impressive than the framework stage. Wood, for instance, has cellulose fibers as the dispersion phase and lignin as the matrix. Reinforced concrete, which includes steel as the dispersion phase and concrete as the matrix, is yet another example of a composite material. One of the main users is the automotive industry. In order to meet some of the most pressing requirements, like lowering the vehicle's overall weight, the mechanical properties of PMCs are especially important in vehicle design. This is because reducing a vehicle's weight increases fuel efficiency and reduces exhaust emissions, thereby reducing air pollution. A 25% decrease in vehicle mass is anticipated to save around 250 million barrels of unrefined oil, while a 10% decrease in vehicle weight increments eco-friendliness by 6% to 8%. To meet the demand for lightweight materials for vehicle applications and other commercial goals, additional research into existing polymer resources, such as waste plastics, has been considered. Work has recently been done to promote the use of secondary materials rather than creating new ones in response to the growing global demand for new materials. In addition, efforts must be intensified to locate application domains compatible with the potentials encoded in derived materials. Guidelines in created nations requiring the utilization of an enormous extent of biodegradable materials in cars, aviation, biomedical gadgets, and different areas made this goal. Natural fillers have also been found to improve the mechanical properties of synthetic polymers and accelerate their breakdown, which has been found to be beneficial to the environment. The use of natural fiber polymer composites (NFPC) in vehicle parts still has significant disadvantages due to issues like high moisture absorption and flammability. Therefore, in order to stop these components from failing in the field, it is essential to resolve such issues. Consequently, hybridization processes combine them with synthetic fibers to produce hybrid composites with improved structural and mechanical properties at lower costs

The aviation industry is one of the most active users of advanced composites. Over half of all advanced composites made in the United States are thought to be consumed by the aviation industry, according to estimates. The automotive industry also makes use of these materials for a number of reasons, some of which are analogous to those that encourage the aerospace industry to do so. Weight reduction, cost savings, and radiation shielding are top priorities in this industry. The number of assembled parts, maneuverability, range, and fuel efficiency are just a few of the parameters that are impacted by weight loss. It has been discovered that polymer matrix enhanced with nanofillers provides superior radiation shielding to metal counterparts. Aluminum, which was previously used for this purpose, has lower attenuation characteristics due to its low electron density and generation of secondary particles. The protecting attribute of polymer composite materials, as well as the choice of building them with high-Z fillers that are nontoxic and give better X-beam insurance, add to their safeguarding effectiveness. Design flexibility, reduced scrap, improved corrosion and fatigue resistance, increased strength and stiffness, resistance to flame and heat for interior panels, improved damage and impact tolerance, durability, reduced noise level, vibration-damping properties, and fracture resistance are additional benefits of using FRP composites in aircraft. Aircraft brakes, bulkheads, window frames, rotors, brackets, fuselage, wing boxes, airframe, fittings, blades, vertical fins, food tray arms, and tail assemblies are just a few of the many uses for polymer composites.

The medical field is acknowledged as the leading industry thanks to the most recent advancements in the utilization of polymer composite materials. The remarkable properties of these materials, such as their compactness, biodegradability, precise control, biocompatibility, biomimicry, and appropriate mechanical strength, make them ideal for biomedical applications. On account of their biocompatibility, biopolymer materials can cunningly imitate the morphological properties of natural materials. Some of their applications include wound dressing, medical devices, tissue engineering, dental use, oral tissues, protein immobilization, medication delivery, regenerative medicine, application of bones and ligaments, blood vessels, antimicrobial materials, and surgical implants. In the biomedical field, natural polymers like chitosan, collagen, guar gum, alginates, agar, pectin, psyllium, pullulan, starch, and cellulose are used. Synthetic polymers like polyamide (PA), polyglycolic acid (PGA), polylactic acid (PLA), polycaprolactone (PCL), polylactic-co-glycolic acid (PLGA), and polyester amides (PE) are also used As a result, PMC are utilized as bone fillers to aid in the repair of bone fractures, one of the most common bone conditions. Degradable polymer composites, both natural and synthetic, are widely used as bone repair scaffolds due to their superior mechanical and biological properties. tainability and environmental effect were also considered, and so environmentally sustainable HA synthesis techniques were devised and employed to produce hydroxyapatite powders (HAp). HAps are currently produced from plants and animals utilizing all available manufacturing techniques [1-5].

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***Address for Correspondence:** Carvy Levert, Department of Science, University of Dhaka, Dhaka, Bangladesh, E-mail: evy@185@edu.in*

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Conflict of Interest

The Author declares there is no conflict of interest associated with this manuscript.

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