

Module 1: Introduction to Composites

Lecture 6: Applications

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Introduction

This lecture is dedicated to the use of composites. The use of composites is almost ubiquitous! The use of composites is an inexhaustive list. In the following we cite some important applications.

What are the applications of the composite materials?

The applications of the composites are given in the following as per the area of application.

Aerospace:

- Aircraft, spacecraft, satellites, space telescopes, space shuttle, space station, missiles, boosters rockets, helicopters (due to high specific strength and stiffness) fatigue life, dimensional stability.
- All composite voyager aircraft flew nonstop around the world with refueling.
- Carbon/carbon composite is used on the leading edges nose cone of the shuttle.
- B2 bomber - both fiber glass and graphite fibers are used with epoxy matrix and polyimide matrix.
- The indigenous Light Combat Aircraft (LCA - Tejas) has Kevlar composite in nose cone, Glass composites in tail fin and carbon composites form almost all part of the fuselage and wings, except the control surfaces of the wing.
- Further, the indigenous Light Combat Helicopter (LCH – Dhruvh) has carbon composites for its main rotor blades. The other composites are used in tail rotor, vertical fin, stabilizer, cowlings, radome, doors, cockpit, side shells, etc.

Missile:

- Rocket motor cases
- Nozzles
- Igniter
- Inter stage structure
- Equipment section
- Aerodynamic fairings

Launch Vehicle:

- Rocket motor case
- Interstage structure
- Payload fairings and dispensers
- High temperature Nozzle
- Nose cone
- Control surfaces

Composite Railway Carrier:

- Composite railway auto carrier
- Bodies of Railway Bogies
- Seats
- Driver's Cabin
- Stabilization of Ballasted Rail Tracks
- Doors

- Sleepers for Railway Girder Bridges
- Gear Case
- Pantographs

Sports Equipments

- Tennis rockets, golf clubs, base-ball bats, helmets, skis, hockey sticks, fishing rods, boat hulls, wind surfing boards, water skis, sails, canoes and racing shells, paddles, yachting rope, speed boat, scuba diving tanks, race cars reduced weight, maintenance, corrosion resistance.

Automotive

- Lower weight and greater durability, corrosion resistance, fatigue life, wear and impact resistance.
- Drive shafts, fan blades and shrouds, springs, bumpers, interior panels, tires, brake shoes, clutch plates, gaskets, hoses, belts and engine parts.
- Carbon and glass fiber composites pultruded over on aluminum cylinder to create drive shaft.
- Fuel saving –braking energy can be stored in to a carbon fiber super flywheels.
- Other applications include: mirror housings, radiator end caps, air filter housing, accelerating pedals, rear view mirrors, head-lamp housings, and intake manifolds, fuel tanks.

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Infrastructure Structures:

- Corrosion is a major design consideration such as in the chemical and on off- shore oil platform forms
- Skeletal Structures
- Walls and Panels
- Doors, Windows, Ladders, Staircases
- Chemical and Water Tanks
- Cooling Towers
- Bridge Decks
- Antenna Dishes
- Bridge enclosures
- Aerodynamic fairings

Industrial:

- Drive,
- conveyer belts,
- hoses,
- tear and puncture resistant fabrics,
- rotor vanes,
- mandrels,
- ropes,
- cables.

Medical:

- Wheelchairs,
- Crutches,
- Hip joints,
- Heat valves,
- Dentistry,
- Surgical equipments

Electronic:

- Chips in electronic computing devices are laminated hybrid systems composed of a number of layers (materials) which serve different functions.
- Chip must have good heat transfer properties and must be able to withstand induced thermal stresses without delaminating.
- The composite finds a vast usage in electronic packaging materials. The Styrofoam, particle bonded materials formed from paper pulp, air-bubble cushioned plastic sheets, etc. are some of the popular materials used in the packing.

Military:

- Helmets,
- bullet proof vests,
- impact resistant vehicles,

- lighter and less detectable ships,
- portable bridges.

Marine:

The Glass reinforced fibre plastics are used in:

- Ship and Boat Hulls
- Masts
- Instrument Panels
- Hydrofoils
- Hovercrafts
- Propellers
- Propulsion shafts
- Rudders
- Heat exchangers
- Flywheel
- Piping
- Ventilation ducts
- Engine and equipment foundations

Wind Power Engineering:

- Rotor blades including blade shell, integral webs, spars or box structure.
- Mast
- Generator housing

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