EN204 ASSIGNMENT 1

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Device chosen for assignment: Wind Turbine Blades

The materials that are used to make a wind turbine blade and their properties that help it function are as follows:

- **FIBERS:**
  - **GLASS AND CARBON FIBERS:**
    The stiffness, tensile and compression strength of composites is determined by the stiffness of fibers and their volume content. Particularly, E-glass fibers (borosilicate glass is also called Electric glass or E-glass due to its high electric resistance) are the material used. Carbon fibers have higher stiffness and lower density than the glass fibers, thus, allowing the thinner, stiffer and lighter blades. But in contrary, they have relatively low damage tolerance, compressive strength and ultimate strain.
  - **ARAMID AND BASALT FIBERS:**
    Aramid (aromatic polyamide) fibers have high mechanical strength, are tough and damage tolerant, but have low compressive strength, low adhesion to polymer resins, absorb moisture, and degrade due to the ultraviolet radiation. Basalt fibers also have good mechanical strength and are lighter than glass fibers.
  - **NATURAL FIBERS:**
    Natural fibers like sisal, flax, hemp and jute enjoy the advantage of environmental friendliness, the disadvantages being high moisture update and low thermal stability of the raw fibers.
- **MATRIX:**
  - **THERMOSETS:**
    The advantages of thermosets are the possibility of room or low temperature cure, and lower viscosity (which eases infusion and thus, allowing high processing speed), although, polyester resins were initially used.
  - **THERMOPLASTICS:**
    Thermoplastics enjoy the advantage of their recyclability, disadvantage being the necessity of high processing temperatures (causing the increased energy consumption and possibly influencing fiber properties) and, difficulties to manufacture large and thick parts, due to the much higher viscosity. The fracture toughness is higher as compared to that of thermosets.
  - **NANOENGINEERED POLYMERS AND COMPOSITES:**
    Additions of small amount of nano-reinforcement in the polymer matrix of composites, fiber sizing or interlaminar layers can allow to increase the fatigue resistance, shear or compressive strength as well as fracture toughness. For example, adding a small amount of material like Carbon Nanotubes (CNT) can increase the lifetime up to 1500%.

SOURCE: DTU Library