Examining Environmentally Friendly Alternatives to Fiberglass Epoxy Resin Used on Wind Turbine Blades

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If glass fiber-reinforced thermoplastic polyurethane's (GFRTPU) strength and strain are comparable to fiberglass epoxy resin, then GFRTPU should be considered a viable alternative material for wind turbine blades. Current wind turbine blades typically use fiberglass epoxy resin, which presents significant recycling challenges. Most blades end up in landfills or are incinerated, creating environmental concerns. This research investigated Elastollan® R3000, a recyclable GFRTPU, as a potential alternative material. Five GFRTPU samples were tested using ASTM Standard D638-22 for tensile properties. Samples were cut to specified dimensions and tested on a 60-kip Satec tensile testing machine. Tensile strength and strain were calculated and compared with published data from epoxy resin adhesives. Elastollan® R3000 demonstrated tensile strengths statistically similar to some epoxy adhesives (BBM2 and BTM2). Notably, the GFRTPU samples exhibited the lowest strain, indicating superior durability under stress. Comparative analysis with wind turbine blade specifications revealed that Elastollan® R3000 could withstand wind speeds up to 78.3 miles per hour with a significant safety factor. The research supports the hypothesis that GFRTPU, specifically Elastollan® R3000, has the potential to be used for the manufacture of wind turbine blades.

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