Name(s)
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Project Number
38147

Project Title
Graphene Oxide Advancement in Technology: Nanoparticle Application in Carbon Fiber Aircraft Design

Abstract

Objectives/Goals
This project is to identify the ideal concentration of Graphene Oxide on carbon fiber and how variation of the graphene oxide concentration affects the tensile strength. I believe as the concentration of the graphene increases, the tensile strength will also increase. If proven successful,an implementation of the enhanced carbon fiber material will be applied to the construction of a prototype radio controlled plane.

Methods/Materials
I used carbon fiber, epoxy, and graphene oxide to create the samples. The independent variable in this case was the % concentration of graphene in the sample controlled by ratio of added graphene oxide to epoxy. Tested the tensile strength of the graphene oxide carbon fiber samples using an UTM(Universal Testing Machine) at Qualcomm Quality Lab and used their camera to take cross sectional pictures. Downloaded the free Autodesk Fusion 360 CAD program online and used for designing some of the RC plane parts and performing simulated stress tests. To construct plane, I used a foam body wrapped with enhanced and un-enhanced carbon fiber, various electrical parts was then inserted and connected by wires such as the motor, battery, and flap control. 2% enhanced carbon fiber was placed strategically in places where high stress would occur during flight; wings and midsection where wings were connected to body. Other parts of the plane were treated with 0% graphene carbon fiber. Flight test occurred after the final construction.

Results
The 2 samples that had the highest load capability contained 2% applied graphene oxide. The 20 additional constructed samples with 2% Graphene were tested and held similar tinsel strength values varying between 1200-1550 (lbf). Cross sectional analysis at the microscopic level showed nano-particle layers forming on the exterior of the carbon fibers for the 2% Graphene sample.

Conclusions/Discussion
The addition of Graphene nano-particles had shown greater load capabilities that grew as a greater concentration of Graphene was applied. The data shows that Graphene had increased the physical properties of the carbon fiber however as more graphene was applied the less elastic it became. The new composite material with 2% Graphene Oxide was then applied to load bearing parts of the RC plane (outer skin and support sections on the wings) to create a lighter and stronger aircraft.

Summary Statement
Graphene Oxide applied to carbon fiber shows an increase in the tensile strength, when used in a plane design it allows for a lighter and stronger aircraft.

Help Received
Qualcomm Quaility lab performed the UTM measurements and took cross sectional pictures.