Master's Thesis Defense Announcement
Mechanical and Aerospace Engineering Department
The University of Texas at Arlington

Synthesis and Characterization of Graphene-Reinforced Polymer Filaments for Additive Manufacturing

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Teams

Abstract

Fused film fabrication (FFF) is a popular 3D printing process which uses a spool of thermoplastic polymer filament that is melted by the movable extruder printer head onto the bed to generate the required shape. The most popular polymer filaments in FFF are Acrylonitrile Butadiene Styrene (ABS) and Poly Lactic Acid (PLA). However, these conventional filaments have low mechanical strength and are more susceptible to shrinkage warping and cracking during cooling. The present investigation provides an understanding of the improvement in properties that graphene provides in the reinforcement of polymer filaments. Graphene is made from a single layer of carbon atoms arranged in a hexagonal lattice. The improved thermal transport properties provided by graphene to the polymer may lead to a lower heat differential between layers being printed and prevent warping from occurring. The high strength-to-weight ratio of graphene may contribute towards mechanically stronger 3D printed parts. Graphene synthesized in our lab will be dispersed inside polymer pellets using a twin-screw micro-compounder to generate a polymer nanocomposite melt which will be converted into polymer filaments using a fiber winding unit. The Graphene is prepared from the oxidation of graphite. The thermal conductivity of the polymer filaments is evaluated to show the benefits of graphene reintroduction. The tensile strength of the polymer filaments will be evaluated to determine change in mechanical properties.