The Electrical Properties of Carbon Nanotube and Graphene Based Filaments for 3D Printed Antennas

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3D printing was conceived as a fast and cost-effective method for creating prototypes for product development within industry. Over the years 3D printers have improved in their concept of development and functional prototyping specifically as office- and user-friendly, cost-effective systems. Previously, carbon nanotubes and graphene have been used as composites to produce electrically conductive filament for 3D printing. This dissertation will develop a new electrically conductive and flexible filament by adding a mixed composite of carbon nanotubes and graphene into an elastomeric polymer matrix, such as polyurethane. Atomic resemblance of graphene and carbon nanotubes results in good compatibility and mixability. Electrical conductivity and mechanical properties of the filament will be optimized by turning the ratio of graphene and carbon nanotubes in the mixed composite and the concentration of the mixed composite in polymer matrix. Electrical conductivity, dynamic mechanical analysis (DMA) and stress / strain test are three core tests in this study. As a demonstration, a 3D printed antenna using the new filaments will be designed and fabricated and tested. Results will be presented regarding the return loss and radiation pattern.