

Improving Mechanical and Magnetic Properties of Strontium Ferrite Filled Polyamide 12 Composite by Surface Treatment

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ABSTRACT

Chemical altering of the surface of the strontium ferrite particles can produce functional groups that can attach to the polyamide 12 matrix. An acid, like nitric or hydrochloric acid, or a silane coupling agent can be a chemical agent. Silane treatment is a surface modification process that involves the application of a thin layer of silane molecules onto a substrate surface. Silane treatment is often used to improve the adhesion between two surfaces, as silane molecules can bond with both organic and inorganic surfaces. The use of silane treatment can also improve the durability and resistance of materials to environmental factors such as water, heat, and UV radiation. Following the chemical treatment, the composite surface can be reacted with low-temperature plasma to create reactive sites which will improve the adhesion. Following the treatment, the filament will be extruded with a twin screw extruder with uniform diameter. The composite filament then will be used for 3D printing by the Fused Filament Fabrication printer to print the test specimens. Mechanical properties will be characterized by tensile and flexure testings. Thermal analysis of the composite will be performed. The Microsensor Biaxial Vibrating Sample Magnetometer will be used to measure the sample's magnetic properties. The distribution of the magnetic particles in the printed material will be examined using a Scanning Electron Microscope, while X-ray diffraction will be utilized to analyze the crystal structure and phase of the magnetic powder. The obtained results will be compared with the composite of strontium ferrite and PA12 without surface treatment and the overall goal of the research is to improve the properties when surface treatment is performed.