DEVELOPING AN ELECTROSTATIC DISCHARGE POLYAMIDE 6 NANOCOMPOSITE FOR 3D PRINTING

by

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ABSTRACT

Polyamide 6 (PA 6) nanocomposites are viable engineered nanocomposite materials with potential application in electrostatic discharge dissipation applications. Creating an electrically conductive path to dissipate electrostatic charges in such materials can be a viable solution to Electrostatic Discharge (ESD) concerns. The addition of nanofillers can also enhance mechanical properties of the parent polyamide 6, a structural thermoplastic ideal for 3D printing via fused deposition modelling (FDM). While improving the ESD capability, it is imperative to sustain the structural integrity of the nanocomposites. Hence, this study evaluated the mechanical, thermal, and electrical properties of 3D printed PA6 Nanocomposites for electrostatic discharge applications. 3 and 5 wt.% of Carbon Nanofiber (CNF) was compounded with PA6 using co-rotating twin screw extruder) to produce 1.75mm diameter monofilaments for fused deposition modelling (FDM). The test samples were printed using commercial-off-the-shelf (COTS) 3D printer, Lulzbot TAZ 6 FDM printer. Mechanical, electrical, and thermal characterization was carried out according to their respective ASTM standard. The tensile and flexural properties were enhanced by 3wt% addition of CNF, but no significant improvement was observed at 5wt%. The CNF nanocomposites exhibited good thermal stability and crystallization phenomenon at both loading levels. The volume resistivity of the of the PA6 matrix was reduced to order of 10^{11} and

10^{12} by 3wt% and 5wt% CNF addition respectively, which seems promising for manufacturing static discharge products.

Key Words: Polyamide 6, Carbon Nanofiber-CNF, Twin Screw Extrusion -TSE, Fused Deposition Modelling- FDM, Electrostatic Dissipation (ESD).