Mechanical and Electrical Characteristics of Exfoliated Graphite Nanoplatelets/Polyamide12 Multifunctional Polymer Nanocomposites Processed by Selective Laser Sintering

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ABSTRACT

Selective laser sintering (SLS), an additive manufacturing method, allows for fabrication of parts with complex geometry without the need of expensive tooling and functionally graded polymer nanocomposites (PNCs). Reinforcing polymers with carbon-based nanofillers can lead to electrical conductive PNCs, enabling them for a wide range of applications that require lightweight multifunctional materials. This study demonstrates SLS fabrication of multifunctional PNCs with boosted mechanical and electrical properties. The nanocomposite powder was prepared by coating the polyamide12 powder with 3 and 5wt% of exfoliated graphite nanoplatelets (xGnP). The composite powder was used to fabricate PNCs by SLS and melt mixing-injection molding as the benchmark process. Mechanical and electrical properties of the parts were determined and compared. The results demonstrated positive effects specific to SLS in enhanced mechanical and electrical properties of the PNCs. SLS PNCs filled with 3wt% xGnP gained greatest tensile modulus of all parts. The sintered PNCs demonstrated enhanced electrical properties, attributed to presence of a network of xGnP with intimate contact of nanofillers. Invariant or suppressed mechanical properties of the sintered parts were correlated to the relatively low density of the parts and poor dispersion of the fillers. The investigations suggested strong correlations between bulk properties and interfacial interactions altered by the manufacturing process.