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Fabrication and Properties of Novel Polymer-Metal Composites Using Fused Deposition Modeling

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ABSTRACT

This study investigated the novel fabrication of polymer-metal composites using fused deposition modeling (FDM), and evaluated the mechanical and physical properties of the new materials. Specifically, an acrylonitrile butadiene styrene (ABS) – 420 stainless steel (SS) composite system was used, with 10, 15, and 23 wt% SS powder additions, and the resulting properties were compared to those of base ABS prepared using the same printing conditions. A new methodology to fabricate the composites was developed. The resulting materials were extruded into composite filaments, which were used to print test specimens. Tensile testing, modulated differential scanning calorimetry, and scanning electron microscopy were employed to characterize the composite materials and evaluate the effects of different print conditions. The results demonstrate, for the first time, the feasibility of using FDM to prepare ABS-SS composites that maintain or enhance mechanical properties as compared to the base polymer, while adding increased functionality.

Keywords: **A.** Structural composites; **B.** Fracture; **B.** Mechanical properties; **D.** Differential scanning calorimetry (DSC); Additive manufacturing

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