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MECHANICAL AND ELECTRICAL PROPERTIES OF CONDUCTIVE ABS AND TPU COMPOSITES FOR MEDICAL APPLICATIONS THROUGH ADDITIVE MANUFACTURING

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Fused Filament Fabrication (FFF) is a widely used additive manufacturing technology, where conductive filaments frequently contain carbon-based fillers. Conductive polymer composites compared with metallic conductors have the advantages of ease of shaping, low density, and wide range of electrical conductivities as well as corrosion resistance.

In this study, static and dynamic mechanical (tensile, three-point bending, Charpy Impact, Shore D hardness tests), and electrical properties (resistance-temperature measurement, resistance measurement during three-point bending test) were investigated on carbon-filled ABS-based (ESD-ABS) and TPU-based (ESD-TPU) conductive 3D printed specimens fabricated using FFF technology.

ESD-ABS specimens compared to ESD-TPU ones had higher flexural Young's modulus and flexural stress at standard deflection. ESD-ABS specimens had higher Shore D hardness than ESD-TPU specimens. Both ESD-ABS and ESD-TPU specimens had a monotonic increase in resistance during the heating phase and a monotonic decrease in resistance during cooling. For both type of specimens at the repeated measurements the resistances during the heating phase were higher than the resistances during the cooling phase at the same temperature. The results of the resistance measurement during the three-point bending test showed that after a first set-up cycle, flexural angle-resistance relationship was linearly increasing between 8 ° and 18 ° for the ESD-ABS specimens. For the ESD-TPU specimens with the growth of the flexural angle the resistance decreased, and after 17 ° the resistance increased.

Composite polymers with carbon additives have opened up the possibilities for medical and low-voltage applications. The investigated ESD-ABS and ESD-TPU composites were found to be suitable for medical sensors and temperature sensors in the tested simple form.

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