

Manufacture of electrically conductive PEEK filaments for 3D printing

José A. Covas¹

Helena Martins², Maria C. Paiva¹, Jordana Gonçalves², U. Lafont³

1. Institute for Polymers and Composites, Univ. Minho, 4800-058 Guimarães, Portugal

2. PIEP - Pole for Innovation in Polymer Engineering, 4800-058 Guimarães, Portugal

3. European Space Agency, TEC-QEE, Noordwijk, The Netherlands

jcovas@dep.uminho.pt

Electrically conductive composites based on high-performance polymers are interesting for use in, e.g., electrostatic dissipation, electrostatic painting, electromagnetic interference (EMI) shielding and lightning strike protection. A combination of high electrical conductivity, mechanical performance and service temperature is considered as particularly relevant for space applications. These requirements could be reached via the preparation of polymer nanocomposites containing suitable fillers. Carbon nanotubes (CNT) and graphite nanoplates (GnP) have excellent mechanical properties and high electrical conductivity. PEEK presents good mechanical properties, high thermal resistance and favours the interactions with those fillers.

The present work reports the manufacture by melt mixing of an electrically conductive composite containing PEEK, GnP and CNT, its processing into a continuous filament and its use in additive manufacturing. Challenges include attaining the required nanoparticle dispersion to achieve a conductive network (which is difficult due to the cohesiveness of the original particle agglomerates) together with good mechanical performance, good surface quality and dimensional precision.

Compositions and processing conditions yielding the higher electrical conductivities

were selected. Then, filaments were obtained by twin screw extrusion and the effect of post-extrusion conditions was assessed. Finally, parts printed by Fusion Deposition Modelling (FDM) were characterized by tensile testing, electrical conductivity, and optical and electron microscopy

Figures



Figure 1: Extruder set-up

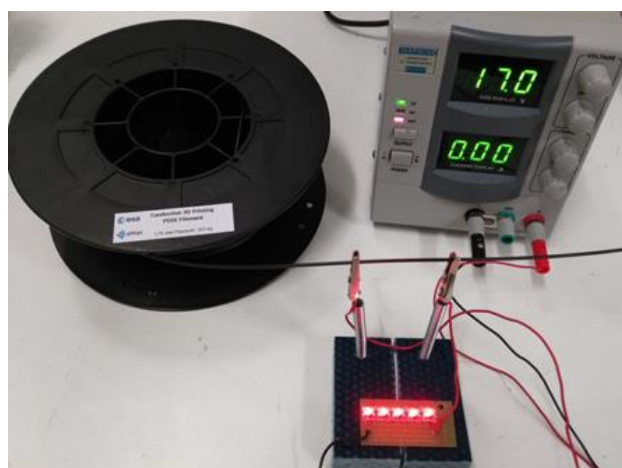


Figure 2: Conductive PEEK filament

