

Master 2008

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Development and characterization of tailor-made materials based on polymers for micro injection molding

ABSTRACT - Masterthesis

This master thesis deals with the behaviour of the electrical conductivity in composites, influenced by the volume concentration, particle size and shape of the filler material. For this purpose, conductive polymer composites have been prepared, where copper, nickel and carbon black powders have been used as conductive fillers and low-density polyethylene as the polymer matrix.

For nickel powder composites, spherical particles with nominal particle sizes of 2.5 μm , 5 μm and a combination of the two were available. Their percolation thresholds were found to be at 14.6%, 26% and 19.8% volume concentration of nickel, with an average conductivity of $3.54 (\Omega\text{cm})^{-1}$, $7.07 (\Omega\text{cm})^{-1}$ and $7.96 (\Omega\text{cm})^{-1}$, respectively. Because powders do not contain only one particle size, but a distribution of sizes, these experiments showed their influence in the electrical conductivity.

Carbon black composites showed percolation threshold at 40% volume concentration of filler with an average electrical conductivity of $0.25 (\Omega\text{cm})^{-1}$. Also, the influence of the particle shape has been corroborated in injection molded composites.

Respect to copper powder, percolation threshold was at 35% volume concentration of filler, with an electrical conductivity of $0.16 (\Omega\text{cm})^{-1}$. Experiments with copper powder composites showed the influence of the process steps to prepare the composites in the electrical conductivity.