THE INFLUENCE OF MORPHOLOGICAL FEATURES ON MECHANICAL PROPERTIES OF INJECTION MOLDED PPS/SEBS BLEND AND ITS PREDICTION USING NEURAL NETWORKS

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The final morphology of an injection molded immiscible polymer blend depends on the characteristics of each component, as well as on the processing conditions, which can produce a heterogeneous and anisotropic morphology along the thickness and along the distance from the gate. The processing conditions with strongest influence on the size and the aspect ratio of the dispersed phase and its distribution in the matrix are mold and melt temperatures, flow rate or injection velocity and holding pressure. The mechanical properties of the injection molded parts are, consequently, controlled by the morphology developed during processing. A homogeneous distribution of the dispersed phase can result, for example, in an increase of toughness and a reduction of the brittle-ductile transition temperature.

The objective of this work was to evaluate the influence of the processing conditions on the developed morphology and on the mechanical properties of an injection molded poly(p-phenylene sulfide) (PPS)/block copolymer styrene-ethylene-butadiene-styrene (SEBS) blend. The processing variable with the highest influence on all mechanical properties was mold temperature. The injection flow rate showed great importance to the elongation at yield and at break. The holding pressure influenced slightly the storage modulus and the intensity of tan delta peak, which is inversely proportional to crystallinity.

Additionally, another objective was to use Artificial Neural Networks, as an alternative to empirical methods and constitutive equations, to predict some features of this morphology and the mechanical properties at different processing conditions.

The first ANN was built to predict the morphological features, like average particle size and average ligament thickness, from the processing conditions: mold temperature, flow rate and holding pressure. The second ANN predicted the mechanical properties: elastic modulus, yield stress, stress at break, elongation at yield, elongation at break and impact strength at room temperature from the morphological features. The third ANN, which was essentially technological, predicted the mechanical properties directly from the processing conditions.