Kinetic studies of polyamide 6 obtained by *in situ* mold polymerization

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The current demands of the automotive market and the global policies concerning sustainability, recyclability and energy efficiency, have attracted researchers to use innovative materials in order to reduce the weight of novel cars. Due to its low density and rigidity, thermoplastic matrix composites have emerged in the automotive industry as an alternative strategy with huge potential, capable of keeping the mechanical properties of thermoset matrix composites.[1]

Thermoplastic materials offer some advantages over thermosets, such as: significantly shorter manufacturing cycle, recyclable nature and, in many cases, higher impact strength.[2]

The reactive anionic polymerization of ε-caprolactam, is one of the most developed forms of reactive processing of thermoplastics.[3]

In this study, new formulations of polyamide 6 (PA6) were developed from the *in situ* polymerization through thermoplastic resin transfer molding (T-RTM) – Figure 1. ε-caprolactam, C10 catalyst and C20P activator, from Brüggemann Chemical, were used as raw material. The polymerization is carried out at temperatures between 130-170 °C (low viscosity).[3] It is an exothermic reaction in which the material temperature increases between 20-40 °C (relative to the processing temperature). At the end of the polymerization process, PA6 is obtained with a conversion rate up to 99%.[4]

The analysis of the non-isothermal crystallization behaviour of previous samples obtained by *in situ* mold polymerization were performed. Using differential scanning calorimetry (DSC), the melting temperature (Tm) and crystallization temperature (T_c) of PA6 at different cooling rates (5, 10, 15, and 20 ºC) were studied and the results were evaluated concerning different kinetic parameters. The results were also compared with values obtained in the literature.

Fourier-transform infrared spectroscopy (FTIR) has also used in order to characterize the structure of PA6 samples obtained by T-RTM process.

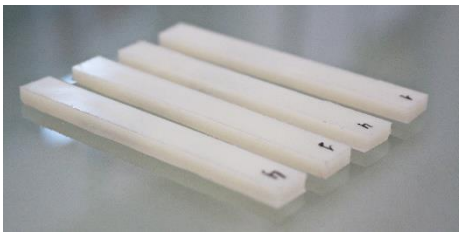

Figure 1. Samples of PA6 obtained by T-RTM process.

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