

Correlation between molar mass and thermal properties of polyoxymethylene (POM) homopolymers

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After extensive investigations dedicated to determine the changes occurring in thermal properties like decomposition, melting and crystallisation temperature by artificial ageing [1-5] of polyoxymethylene (POM) homopolymer Delrin® 900P (DuPont), in the present study, the influence of the molar mass on the earlier-mentioned characteristics is investigated. For this purpose, in addition to the previously mentioned grade three other resins namely Delrin® 100P, Delrin® 500P and Delrin® 1700P were investigated for their thermal properties. The Delrin® resins differed in their molar mass with 100P being a high molar mass resin and 1700P being a low molar mass resin.

The Delrin® resins were supplied from DuPont both as pellets and as test specimens according to ISO 527. First, the characteristics of the resins were investigated as received by means of attenuated total reflection (ATR) Fourier transform infrared spectroscopy (FTIR), thermogravimetric analysis (TGA) coupled with mass spectrometry (MS), and differential scanning calorimetry (DSC). Further, a thermooxidative ageing was realised by storing the samples in an oven at 140 °C.

In general no significant differences in the FT-IR spectra obtained on the test specimens of the different resins could be observed. This was also true for the results gathered from DSC measurements. The TGA results showed that regardless the molar mass of the resins already the processing of the pellets by injection moulding leads to a decrease in the onset temperature (T_0) both in air and in nitrogen atmosphere. Further, it could be shown in isothermal TGA experiments that the high molar mass resin (100P) degraded earlier than the lower molar mass resin (1700P). This was also true for the aged specimens where the degradation started remarkably earlier because of the lower effective stabiliser content.

In the FT-IR spectra of artificially aged samples a moderate change in the absorption bands associated with the thermal history [6] could be observed.

References

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