An optimized preparation of bismaleimide-diamine co-polymer matrices

Abstract

The main aim of this study was to develop an improved method for the preparation of a bismaleimide-diamine (BMI/DDM) polymer matrix, achieving shorter curing time, longer processing time (pot life), and good thermal mechanical properties. A matrix of BMI/DDM thermoset was prepared at optimal conditions and formulation, containing BMI and DDM in a 2:1mol ratio with 0.1wt% of dicumyl peroxide (DCP) as the curing accelerator. An optimal temperature of 150°C was selected for both melt-mixing and curing processes. The mechanism of matrix preparation was also investigated using differential scanning calorimetry and quantitative Fourier transformed infrared analysis. DCP at the optimal concentration was found to accelerate cross-linking reactions between BMI and DDM without inhibiting the chain-extension reaction of BMI. The specified formulation exhibited longer gel time (208s/g) and shorter post-curing time (2h) compared to other formulations. In addition, thermomechanical behavior and thermal stability were analyzed by dynamic mechanical analysis and thermomechanical analysis, and thermogravimetric analysis, respectively. The storage modulus (E'), glass transition temperature (Tg), and decomposition temperature (Td) of the BMI/DDM thermosets increased with the BMI content of the formulations, while the coefficient of thermal expansion and damping behavior (tan δ) decreased in a similar manner, primarily because of an increase in the degree of cross-linking.