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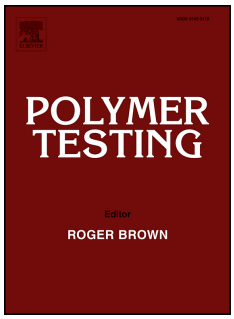

Influence of different polyol segments on the crystallisation behavior of polyurethane elastomers measured with DSC and DMA experiments

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Influence of different polyol segments on the crystallisation behavior of polyurethane elastomers measured with DSC and DMA experiments

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Abstract:

Polyurethane elastomers are polymers that exhibit both outstanding stability and flexibility and are commonly used in the sector of building and construction to absorb vibrations. Long-chained linear molecules, more precisely macrodiols, are used as the soft phase within the elastomer. The tendency of the used polyetherols to crystallise within the polymer between -40 and +30 °C, depending on the molecule's chain length, is a major disadvantage since consistent properties over a broad temperature range are desired to have no limitations considering the elastomers' application fields. In this work, crystallisation phenomena in polyurethane elastomers due to the long-chained polyetherol components were investigated in detail with DSC and DMA experiments. Possible measures to reduce these phenomena by changing the chemical constitution, were defined. Two kinds of short-chained polyols were introduced into the system to be combined with the long-chained polyetherol component, acting as diluents and creating different networks. As a bifunctional alcohol, 1,4-butanediol was chosen, creating a larger number of hard phases (physical cross-links) within the polymer. Glycerol was used as a trifunctional alcohol, responsible for covalent threedimensional linkages (chemical cross-links). The addition of 1,4-butanediol did not eliminate, but reduced the crystallisation tendency of the polyetherol component and led to a higher storage modulus above room temperature. If a certain amount of glycerol is added to the polymeric system, it prevents the cold crystallisation. Furthermore, glycerol reduced the drop of the storage modulus at elevated temperatures due to the chemical cross-links.

Keywords:

polyurethane elastomer; crystallisation of polyetherol; physical cross-links; chemical cross-links; DSC; DMA