

INFLUENCE OF DIFFERENT PLASTICIZERS ON THE GLASS TRANSITION TEMPERATURE OF MIXTURES WITH ENERGETIC THERMOPLASTIC ELASTOMERS

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Abstract:

Conventional gun propellants are mainly based on nitrocellulose, inert and/or energetic plasticizers and stabilizers. A new type of gun propellants is based on energetic thermoplastic elastomers (ETPE) instead of nitrocellulose as binder material. The present study reports the investigation of the influence of different energetic plasticizers on the glass transition temperature of mixtures with the energetic GAP-based thermoplastic elastomer (GAP-ETPE). Three different types of energetic plasticizers are chosen: Dinitrodiazaalkane (DNDA-57), N-Ethyl-N-(2-Nitroxyethyl)-nitramine (Et-NENA) and Glycidylazidopolymerazide (GAP-A). The ratio of GAP-ETPE to plasticizer was varied from 90:10, 75:25 till 50:50. GAP-ETPE was mixed with the different plasticizers and after evaporation of the solvent the glass transition temperature was determined by DSC-measurements (DSC=Differential Scanning Calorimetry). There was no phase separation or any other signature of heterogeneity in these binder mixtures. This indicates that the plasticizers are all compatible with GAP-ETPE. All plasticizers effectively plasticizes the GAP-ETPE and improved the low temperature flexibility in the formulation. The extent of the reduction of the glass transition temperature of GAP-ETPE is different depending on the plasticizer used. The following figure shows the DSC-measurements of mixtures of GAP-ETPE with GAP-A. The virgin GAP-ETPE has a glass transition temperature of -30.35°C.

Similar data were obtained investigating the mixtures of GAP-ETPE with Et-NENA and DNDA-57.

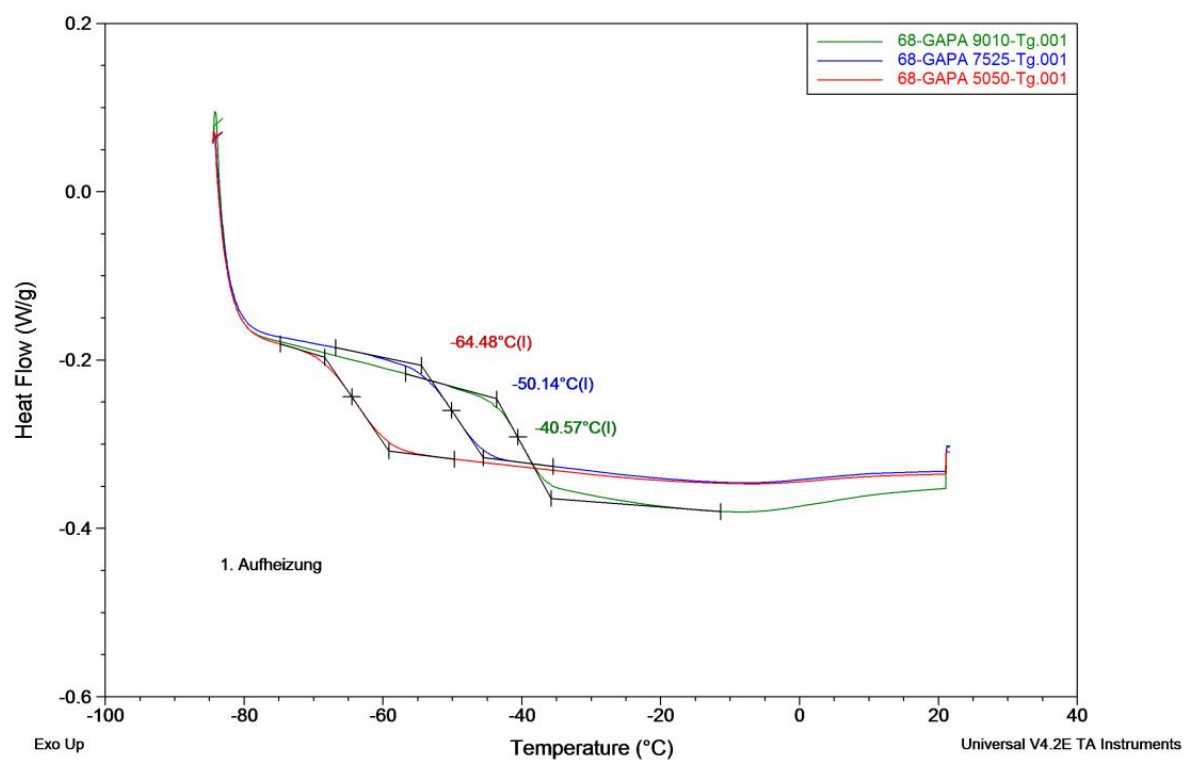


Figure 1: DSC-measurements of different mixtures of GAP-ETPE with GAP-A in the ratios 90:10, 75:25 and 50:50