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Effect of Hydrolytic Degradation On The Mechanical Property of a Thermoplastic Polyether Ester Elastomer

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ABSTRACT

Polymers with a finite lifetime are of great interest for oil and gas industry. Thermoplastic elastomers (TPEs) combine the strength of thermoplastics with the flexibility of elastomers, a characteristic also potentially useful in oil and gas applications. We studied the hydrolytic degradation of a TPE of interest at elevated temperatures from both a mechanical and chemical perspective, and have demonstrated that the chemical degradation rates, the change in crystallinity and the storage modulus all follow the pseudo zero order kinetics with respect to varying time at three temperatures. Applying Arrhenius' empirical relationship to the determined rates gives rise to a temperature-dependent model that predicts the degradation behavior of the TPE outside of the experimental temperature range. Our results indicate that hydrolytic degradation leads to an increase of crystallinity (chemicrystallization) and a decrease of tensile strength and strain, and that the increase of crystallinity strongly correlates to the increase of the storage modulus. The polymer eventually deteriorates due to brittleness.

Keywords: thermoplastic elastomers, hydrolytic degradation, chemicrystallization, kinetics, morphology, mechanical properties

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