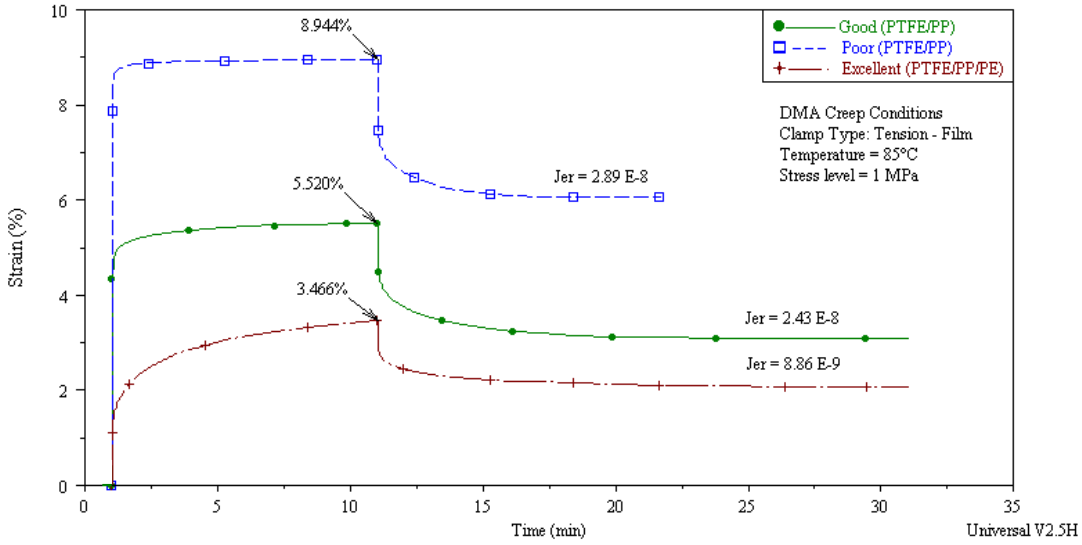
THERMAL SOLUTIONS

Characterization of Packaging Film Performance by DMA Creep Recovery Analysis



DMA measures the modulus (stiffness) and damping (energy dissipation) properties of materials as they are deformed under a periodic stress. These measurements provide quantitative and qualitative information about the performance of materials. DMA is particularly useful for evaluating polymeric materials which exhibit time, frequency, and temperature effects on mechanical properties because of their viscoelastic nature.

In a thermoforming process, the film is pulled down into a heated mold to form a desired shape. A thermoformed film has to keep its shape when formed to fit over the product it needs to cover. Creep-recovery measurements can be used to predict the thermoforming characteristics of the plastic films. By conducting creep-recovery measurements at the forming temperature, you can predict if the fill will have sufficient elasticity to hold it's shape and produce a stable product. A measure of elasticity that can be obtained from a creep-recovery experiment is the equilibrium recoverable compliance, J_{er}. In a creep-recovery test, a stress is applied to the sample and the resultant strain generated at that stress is measured for a specific time period. The stress is then dropped to zero and the recoverable strain is measured as a function of time. When all reversible deformation is recovered, the equilibrium recoverable compliance can be calculated from the following equation:

$J_{er} = (\gamma_c - \gamma_r(t))/\sigma$ where γ_c is the maximum strain in the creep zone, $\gamma_r(t)$ is the time dependent recoverable strain, and σ is the stress applied in the creep zone.

The above plot shows creep-recovery measurements on three coextruded polymer films done at the forming temperature (in this case 85°C). The equilibrium recoverable compliance is calculated for each sample. The lower the equilibrium recoverable compliance, the higher the elasticity. If the sample compliance is too high, as observed by a high J_{er}, then the elasticity may be too low at the forming temperature to maintain the desired shape.

For additional details, see Thermal Solutions TS-47 and TS-48.

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For additional details, see Thermal Solutions TS-47 & TS-48 for more DMA information.

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