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Concurrent Physical Aging and Polymer Degradation during Weathering of Coatings[1] STUART CROLL, DILHAN FERNANDO, North Dakota State University — A polyester-urethane coating system was subjected to "accelerated" weathering cycles under UV light, elevated temperature and moisture (in a Q-Sun 1000 chamber). Cross-link density values obtained from high temperature modulus data demonstrated chain scission with increased exposure. However, increasing Tg and tensile modulus with weathering require an additional explanation to chemical degradation. Physical aging was explored to explain the behavior. Regular and modulated DSC analysis of the coating clearly shows increasing enthalpy recovery with increased weathering of the coating. Enthalpy recovery rate in degraded polymer films was much larger than in films that had only undergone the thermal component of exposure. An effort was also made to characterize the concurrent physical-chemical aging effects by tracking the changes in the non-linearity of the molecular relaxation times and the distribution of molecular relaxation times of the weathered coating. Understanding the physical relaxation properties of polymers subjected to accelerated weathering may help in resolving differences between natural weathering and accelerated weathering cycles, and also may be used to refine models for lifetime prediction of coatings.

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