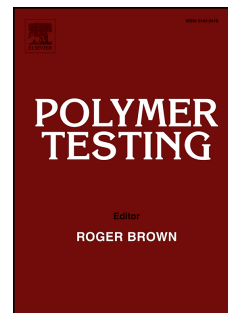


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Multivariate correlation analysis of outdoor weathering behavior of polypropylene under diverse climate scenarios

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Abstract: A full understanding on the relationships between weathering factors and deteriorations in the physical or mechanical properties of polymeric materials as well as their intercorrelations is critically important to forecast the durability of materials. In this work, the outdoor weathering behaviors of isotactic polypropylene (iPP) across a 1.5-year period under six typical climate scenarios in China are investigated. A wide sets of natural exposure conditions and test methods allow the establishment of the substantial correlations between chemical/physical structures and appearance/mechanical properties under simultaneous effects of multiple weathering factors (such as light, heat, oxygen etc.). The results under diverse natural environments suggest that the crystallinity and crack development depend largely on the molecular weight while the yellowing index correlates directly with the carbonyl index irrespective of the exposure conditions. The relationship between tensile strength and molecular weight is found to be in accord with an empirical linear model. Subsequently, using principal component analysis (PCA), a data reduction and visualization method, the degradation risk map of PP materials in China is established and the relative importance of relevant weathering factors is evaluated. Temperature is found to be the most dominant weathering factor on iPP aging under the climate scenarios investigated in the present work.

Keywords: Polypropylene; Weathering; Correlations; Principal component analysis

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