

**A STATISTICAL MODEL FOR LINKING FIELD AND LABORATORY
EXPOSURE RESULTS FOR A MODEL COATING**

by

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ABSTRACT

Today's manufacturers need accelerated test (AT) methods that can usefully predict service life in a timely manner. For example, automobile manufacturers would like to develop a three-month test to predict 10-year field reliability of a coating system (an acceleration factor of 40). Developing a methodology to simulate outdoor weathering is a particularly challenging task and most previous attempts to establish an adequate correlation between laboratory tests and field experience has met with failure. Difficulties arise, for example, because the intensity and the frequency spectrum of ultraviolet (UV) radiation from the Sun are highly variable, both temporally and spatially and because there is often little understanding of how environmental variables affect chemical degradation processes. This paper describes the statistical aspects of a cooperative project being conducted at the U.S. National Institute of Standards and Technology (NIST) to generate necessary experimental data and the development of a model relating cumulative damage to environmental variables like UV spectrum and intensity, as well as temperature and relative humidity. The parameters of the cumulative damage are estimated from the laboratory data. The adequacy of the model predictions are assessed by comparing with specimens tested in an outdoor environment for which the environmental variables were carefully measured.

Key words: Cumulative damage, Nonlinear regression, Photodegradation, Prediction, Reliability, Weathering