

# Service Life Prediction of Exterior Plastics



Christopher C. White • Jon Martin  
J. Thomas Chapin  
Editors

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Vision for the Future

 Springer

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# Preface

Risk permeates every aspect of product commercialization. How risk is assessed, therefore, is critical to ability and rapidity of an industry to innovate. This volume updates progress in delineating advances in the state of the art in service life prediction for polymeric materials exposed outdoors. Accurate in-service performance estimates would greatly reduce risk in introducing a product into the marketplace. By increasing the reliability of the predictions for polymeric materials, the pace of innovation in industries that rely on these materials will also increase.

The mission of the 5th International Symposium on Service Life Prediction, which was held in Monterey California on March 3–8, 2013, was to provide an international forum for presenting and discussing the latest scientific and technical advances leading to more reliable and quantitative predictions for the weathering performance of polymeric materials. This meeting had three concurrent, underlying themes: a symposium on service life prediction for all polymer containing systems, a workshop on changes to the Underwriters Laboratories' (UL) UL 746 standard testing requirements, and a National Science Foundation workshop on Composite Durability. The objectives of each theme were identical and involved the following:

- To critically examine the methods and methodology used to assess current service life prediction.
- To present advances in laboratory, field exposures, and modeling approaches leading to more quantitative results that are both repeatable and reproducible.
- To discuss strategies for implementing these advances
- To identify outstanding issues related to implementation of these advances.

Ninety-five distinguished scientists attended the symposium including 21 scientists from 11 countries and 50 technical presentations. Each day was divided into a morning session devoted to service life prediction and an afternoon session involving a discussion of UL 746. Sessions near the end of the week were focused on the NSF composite durability workshop.

The opening talks of the workshop were focused on an overview of the current state of the art in service life prediction. A number of statistical models were presented including work on silicone hard coats and reflective outdoor coatings.

This was followed by the results of a number of case studies of exposure on a variety of materials including wood-plastic composites, polymer sport field coverings, and subcomponent systems common to photovoltaic panels. Degradation of commodity thermoplastic and thermoplastic systems was also presented.

A vigorous discussion followed a series of talks on the limitations of service life predictions models, tools, procedures, and methods. This discussion focused on ensuring that the increase in any factor does not change the mechanism of degradation. As an example, increasing the temperature beyond a phase change in the polymer, such as the glass transition temperature, could change the dominant mechanism of degradation for the polymer material.

The NSF composite workshop included presentations on molecular modeling of the materials from molecular dynamics models to constitutive models of behavior. Also included were a series of discussions on the thermo-mechanical effects on polymer composites.

Excellent papers were presented in all areas of service life prediction including advances in modeling, field and laboratory exposures, and characterization techniques.

A common concern from discussions following the presentations involved the treatment of water in models and experiments. Water, when it is included in the models, is characterized by the relative humidity and not the activity of water within the material. Water is also present as rain, ice, and steam within these materials. A focus on including a more detailed and accurate description of water will be a focus of future research.

Throughout the conference, a dedicated group of researchers labored to improve the methods, tools, and techniques underlying Underwriters Laboratory methods. These methods, specifically the UL 746 standard test methods, are instrumental in assuring the safety of commercial products used in everyday life. The goal of the UL 746 sessions was to increase this safety level while decreasing the time needed to obtain a UL 746 safety certification. The hard work of these researchers is summarized in the first paper presented in this volume.

The editors thank the Monterey organizing committee as well as the authors and participants for making the 5th International Symposium a success. The organizing committee, cochaired by Tom Chapin (UL), Anastasia Muliana (Texas A&M), Valeria La Saponara (University of California Davis), and Chris White (NIST) included:

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