

PREP Research Associate

Durability Assessment of Polymeric Materials Used in Civil Infrastructure Applications

This position is part of the National Institute of Standards (NIST) Professional Research Experience (PREP) program. NIST recognizes that its research staff may wish to collaborate with researchers at academic institutions on specific projects of mutual interest and thus requires that such institutions be the recipients of a PREP award. The PREP program requires staff from a wide range of backgrounds to work on scientific research in many areas. Employees in this position will perform technical work that underpins the scientific research of the collaboration.

Research Title:

Postdoctoral Researcher on Civil Infrastructure Polymer Durability

The work will entail:

The PREP Researcher will conduct laboratory accelerating weathering exposure experiments on various polymer systems used in infrastructure applications, which will include building envelope materials, protective coatings, crack repair materials, and fiber reinforced polymer composite (FRP) retrofits. The PREP Researcher will help to identify select polymeric infrastructure materials in widespread use based on current limitations of these materials, identified research gaps, and identified durability issues. Accelerated weathering experiments will primarily take place on the state-of-the-art NIST SPHERE (Simulated Photodegradation via High Energy Radiant Exposure) device which allows precise control of temperature and relative humidity while exposing samples to highly uniform ultraviolet (UV) exposure. Other weathering exposure experiments in humidity chambers, a freeze/thaw chamber, a corrosion chamber, commercial UV-weathering devices, or at two outdoor weathering fields may be conducted. The PREP researcher will collect material property change data resulting from degradation and develop test configurations and methods to measure performance changes of an infrastructure material with respect to its given application (e.g., increased water penetration of a building envelope material). Alongside structural engineers, weathering data criteria will be collaboratively incorporated into design equations and structural models.

U.S. Citizen Preferred

Key responsibilities will include but are not limited to:

- Review literature and sample degradation results from previous SPHERE and outdoor weathering experiments.
- Help identify a select few polymeric infrastructure materials for durability assessment that will have a high impact for stakeholders. Identification efforts should involve literature reviews, stakeholder engagement, and market research. Building envelope materials will be highest priority.
- Conduct accelerated weathering exposure on the NIST SPHERE and on other weathering devices, as appropriate.

- Characterize the chemical, optical, and mechanical property changes of weathered infrastructure polymer samples using techniques such as ATR-FTIR, Raman, UV-Vis, color and gloss tests, DSC, TGA, pull-off testing, three-point bending tests, moisture absorption tests, infrared thermography, and microscopy.
- Develop test configurations and test methods to measure performance changes of a material within a given infrastructure application. This may include water vapor transmission tests, corrosion tests, tensile tests, impact and tear resistance tests, etc.
- Maintain the NIST SPHERE in collaboration with NIST technicians: this includes collecting, recording, and analyzing irradiance data.
- Construct a UV-degradation database for correlating materials-structure-performance properties. Contribute to a NIST SPHERE metadata database.
- Present results within the group and other related meetings, write protocols, technical reports, and prepare manuscripts for high impact, peer-reviewed publications.
- Ensure that results, protocols, software, and documentation have been archived.

Qualifications

- The ideal candidate will possess a deep background in materials science, strictly focused on the fundamental degradation of polymers in outdoor service environments. A Ph.D. degree in Materials or Chemical Engineering, Mechanical Engineering, Environmental Engineering, Chemistry, or a related polymer science field.
- Demonstrated hands-on laboratory experience with at least four of the following techniques: tensile tests, DMA, nanoindentation, DSC, TGA, FTIR spectroscopy, Raman spectroscopy, UV-Vis spectroscopy, color and gloss tests, optical microscopy, scanning electron microscopy, infrared thermography, pull-off tests, three-point bending tests, moisture absorption tests.
- Experience evaluating long-term degradation of polymeric materials and/or the use of accelerated weathering techniques in prior research efforts.
- Experience using analysis software (e.g., Excel, Origin, SolidWorks).
- Experience using R or Python for database development and data analysis is a plus.
- Ability to work with real-time event data at-scale.
- Ability to develop prototypes of tools needed to analyze data.
- A strong record of scientific productivity, evidenced by publications in peer-reviewed journals.

Privacy Act Statement

Authority: 15 U.S.C. § 278g-1(e)(1) and (e)(3) and 15 U.S.C. § 272(b) and (c)

Purpose: The National Institute for Standards and Technology (NIST) hosts the [Professional Research Experience Program \(PREP\)](#) which is designed to provide valuable laboratory experience and financial assistance to undergraduates, post-bachelor's degree holders, graduate students, master's degree holders, postdocs, and faculty.

PREP is a 5-year cooperative agreement between NIST laboratories and participating PREP Universities to establish a collaborative research relationship between NIST and U.S. institutions of higher education in the following disciplines including (but may not be limited to) biochemistry, biological sciences, chemistry, computer science, engineering, electronics, materials science, mathematics, nanoscale science, neutron science, physical science, physics, and statistics. This collection of information is needed to facilitate administrative functions of the PREP Program.

Routine Uses: NIST will use the information collected to perform the requisite reviews of the applications to determine eligibility, and to meet programmatic requirements. Disclosure of this information is also subject to all the published routine uses as identified in the Privacy Act System of Records Notices: NIST-1: NIST Associates.

Disclosure: Furnishing this information is voluntary. When you submit the form, you are indicating your voluntary consent for NIST to use of the information you submit for the purpose stated.