Improving the Hygrothermal Durability Performance of Lignocellulose-Biopolymer Composite Materials *via* Chemical Modification

Wil V. Srubar III
Department of Civil and Environmental Engineering
PhD Candidate, Stanford University

Advisor: Sarah L. Billington
Department of Civil and Environmental Engineering
Associate Professor, Stanford University

ABSTRACT

Employing a cradle-to-cradle design methodology, rapidly renewable, fully biodegradable composite materials fabricated using natural lignocellulose as reinforcement in matrices derived from poly(β-hydroxybutyrate)-*co*-poly(β-hydroxyvalerate) (PHBV), are being investigated as potential alternatives to traditional construction materials in both structural and non-structural applications. PHBV is a biodegradable thermoplastic that exhibits similar properties to many conventional petroleum-based resins and synthetic plastics. The inherent hydrophobicity of the polymer matrix in combination with the hydrophilicity of natural fibers renders the biobased composite particularly susceptible to in-service hygrothermal degradation.

This presentation will discuss the effectiveness of two chemical modification techniques, namely silane thermochemical vapor deposition (fiber treatment) and maleic anhydride copolymerization (matrix treatment), employed to improve the moisture resistance of the PHBV-based composites. Results show that the fiber-matrix compatibilization techniques reduce composite diffusivity by promoting better fiber wettability and dispersion. In addition to experimental results, the development and validation of an analytical hygrothermal deterioration model and a numerical service-life model for wood-biopolymer composites will be presented.