ABSTRACT

There is widespread interest in the development of large-scale, economically competitive biorefineries, which combine integrated thermal, chemical and biological conversion processes to efficiently utilize all of the materials and energy contained in lignocellulosic biomass. However, the emergence of commercial large-scale biorefineries depends significantly on our ability to advance technologies that improve biomass-derived product diversity, value, and yield. A central, long-standing challenge has been decoding the complexity and heterogeneity of molecular-scale structure and nano-/meso-scale architecture that comprise biomass. My research has focused on improving our understanding of the molecular structures and interactions that affect the industrial conversion of lignocellulosic biomass and its components (i.e., cellulose, hemicellulose, and lignin) into useful and value-added products (e.g., liquid fuels, chemicals, and materials). In particular, my lab seeks to resolve the multi-scale complexity of biomass and its components in an effort to understand the causes and effects of biomass structure-derived limits on conversion performance. With that understanding, we seek to rationally engineer biomass conversions processes that take advantage of the unique features of biomass as a feedstock to access new products. This seminar will highlight my contributions to the research areas of: (1) understanding the cause and effect of biomass recalcitrance and (2) elucidating the structure-processing-performance relationships that underpin lignin valorization technologies.

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Marcus Foston is an assistant professor in the Energy, Environmental, and Chemical Engineering Department at Washington University in St. Louis. He received his PhD in polymer chemistry in the Material Science and Engineering Department at the Georgia Institute of Technology and soon after completed a postdoctoral fellowship in the School of Chemistry and Biochemistry at the Georgia Institute of Technology. His current research program focuses on understanding of the molecular structures and interactions that affect the industrial conversion of lignocellulosic biomass and its components (i.e., cellulose, hemicellulose, and lignin) into useful and value-added products (e.g., liquid fuels, chemicals, and materials). Dr. Marcus Foston primary research themes are: (1) catalytic depolymerization biopolymers into value-added products, (2) interfacing biological upgrading with catalytic depolymerization of biopolymer, (3) developing novel methods of biomass characterization, and (4) synthesis and characterization of biomass-derived monomers, polymers, and composites.

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