"Local Polymer Interfacial Mechanics: Effect of Topological and Chemical NanoPatterning"

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Bio: **L. Cate Brinson** is the Sharon C and Harold L Yoh III Professor of Engineering and the Donald M Alstadt Department Chair of the Mechanical Engineering and Materials Science Department at Duke University. She received her BS from Virginia Tech, PhD from Caltech, did a postdoc at the DLR in Germany and began her academic career at Northwestern University in 1992, serving in many roles, including as Department Chair for Mechanical Engineering and an Associate Dean in the McCormick School of Engineering. She is an expert in the broad area of mechanics of materials, with emphasis on complex hierarchical materials and polymer based systems, and merging concepts of data science into materials. Experimental and computational work spans the range of molecular interactions, micromechanics and macroscale behavior. Current research foci include nanostructured polymers, interfacial behavior, structural metamaterials and data platforms for material query and design. Dr. Brinson has received a number of awards, including the *Eringen Medal* of SES, the *Nadai Medal* of the ASME, the *Friedrich Wilhelm Bessel Prize* of the Alexander von Humboldt Foundation, the *ASME Tom JR Hughes Young Investigator Award*, and an *NSF CAREER Award*. She has authored one book and over 170 refereed journal publications with nearly 30000 citations and an h-index of 74 in Google Scholar. Her book Polymer Engineering Science and Viscoelasticity has had over 150,000 chapter downloads from the e-version since publication. She served 5 years on the *Society of Engineering Science* Board of Directors, one year as President, and is a founding member of the *Materials Research Data Alliance* (MaRDA).

Abstract: Confinement and interfaces affect the mechanical properties of polymers in thin films, nanoscale structures in microelectronics, drug delivery devices, and nanocomposites. However, conflicting reports on the effect of confinement on polymer modulus - even regarding the qualitative nature - create a significant challenge in advancing our understanding and effective use of these materials in many applications.
This work addresses open questions on how interactions with multiples surfaces and how different surface chemistries affect the surface-proximal, dynamic-mechanical properties of confined polymers. The **goal** of this work is to characterize the local mechanical gradients in confined polymers by applying advanced atomic force

microscopy (AFM) characterization coupled with targeted finite element analysis (FEA) to novel polymer-substrate interface model systems. These model systems are designed as well-defined mimics of confined polymers in real design applications and provide an avenue for increased characterization efficiency by leveraging a combinatorial approach.

Specifically, nanomechanical AFM techniques, in conjunction with finite element modeling, are used to probe the effects of local geometric confinement and chemical interactions on polymer interphase properties. Due to the generally complex configuration of polymers in applications, model substrate systems are designed to study multi-body compound effects arising from simultaneous interactions of local polymer domains with multiple interfaces. To accelerate data collection and analysis, substrate samples are fabricated that provide many replicate interphase conditions in one single sample.