BIOGRAPHICAL SKETCH

NAME: Grady, Martha Elizabeth

POSITION TITLE: Assistant Professor of Mechanical Engineering

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	Completion Date MM/YYYY	FIELD OF STUDY
University of Central Florida	B.S	05/2008	Mechanical Engineering
University of Illinois at Urbana-Champaign	M.S.	08/2011	Theoretical and Applied Mechanics
University of Illinois at Urbana-Champaign	Ph.D.	05/2014	Theoretical and Applied Mechanics
University of Pennsylvania	Postdoctoral	07/2014	Materials Science & Engineering Anesthesiology & Critical Care

A. Personal Statement

My career goals include developing a research program to characterize interfaces between hard and soft materials at the intersection of biology, nanotechnology, and mechanics. I intend to overcome challenges in implantable material technology by adapting nano-manufacturing methods for use in biological applications. Biocompatibility is a crucial factor in designing these devices where an understanding of nanoscale characterization and mechanics of materials is essential. My expertise in tailoring the properties of thin film-substrate systems and evaluating cellular mechanics makes me uniquely poised to solve interfacial adhesion challenges relevant to medical applications. I have a broad background in thin film mechanics, with specific training and expertise in high strain rate techniques, dynamic adhesion measurement, and materials characterization. My prior research includes molecular tailoring of interfaces for a variety of thin film on substrate systems. As an experimental solid mechanician, I laid the groundwork for the proposed research by developing the laser spallation technique for adhesion measurement of material interfaces too strong for traditional methods as well as expanding the functionality to induce strains across mechanochemically active molecules. In addition, I successfully collaborated with the departments of Chemistry, Materials Science, and Aerospace Engineering to produce several peer-reviewed publications from each project. As a result of these previous experiences, I am aware of the multidisciplinary nature of the proposed project and have recruited a team of researchers from the College of Dentistry with expertise in microbiology and periodontal disease to complement my strengths.

1. Losego, M. D., **Grady**, M. E., Sottos, N. R., Cahill, D. G., Braun, P.V., "Effects of Chemical Bonding on Heat Transport Across Interfaces," *Nature Materials*, 11, 502-506, (2012).
2. **Grady**, M. E., Geubelle, P. H., Sottos, N. R., "Interfacial Adhesion of a Photodefinable Polyimide on Passivated Silicon," *Thin Solid Films,* 552, 116-123, (2014).
3. **Grady**, M. E., Geubelle, P. H., Sottos, N. R., "Molecular Tailoring of Interfacial Failure," *Langmuir,* 30, 11096–11102, (2014).
4. **Grady**, M. E., Beiermann, B. A., Moore, J. S., Sottos, N. R., "Shockwave Loading of Mechanochemically Active Polymer Coatings," *ACS Applied Materials & Interfaces*, 6, 5350-5355, (2014).

B. Positions and Honors

Positions and Employment

2008-2014 Research Assistant, University of Illinois at Urbana Champaign, Urbana, IL
2014-2016 Postdoctoral Fellow, Vice Provost for Research Postdoctoral Fellowship for Academic Diversity, Materials Science & Engineering and Anesthesiology & Critical Care, University of Pennsylvania, Philadelphia, PA
2016-current Assistant Professor, Mechanical Engineering, University of Kentucky, Lexington, KY

Manuscript Reviewing
ACS Biomaterials Science & Engineering
American Society for Engineering Education

Other Experience and Professional Memberships

2002-	Member, Society of Women Engineers
2011-	Member, Society of Experimental Mechanics
2014-	Member, American Society of Engineering Education

Honors

2009	Semiconductor Research Corporation Master's Scholar Award
2012	List of Teachers Ranked as Excellent by their Students
2013	Graduate Certificate in Foundations of Teaching
2014	Vice Provost Postdoctoral Fellowship for Academic Diversity
2015	UCF MAE Alumni Young Engineer Award

C. Contribution to Science

1. My foundational contribution to science is within the field of thin film materials. Thin film on substrate systems appear most prevalently within the microelectronics industry, which demands that devices operate in smaller and smaller packages with greater reliability. The reliability of these multilayer film systems is strongly influenced by the adhesion of each of the bimaterial interfaces. The ability to tailor interfacial properties at the molecular level provides a mechanism to improve thin film adhesion, reliability and performance. I successfully demonstrated molecular level control of interface properties in three thin film on substrate systems: photodefinable polyimide films on passivated silicon substrates, self-assembled monolayers at the interface of Au films and dielectric substrates, and mechanochemically active materials on glass. For all three materials systems, the effect of interfacial modifications on adhesion is assessed using the laser-spallation technique.
    a. Losego, M. D., **Grady**, M. E., Sottos, N. R., Cahill, D. G., Braun, P.V., "Effects of Chemical Bonding on Heat Transport Across Interfaces," *Nature Materials*, 11, 502-506, (2012).
    b. **Grady**, M. E., Geubelle, P. H., Sottos, N. R., "Molecular Tailoring of Interfacial Failure," *Langmuir,* 30, 11096–11102, (2014).
    c. **Grady,** M. E., Beiermann, B. A., Moore, J. S., Sottos, N. R., "Shockwave Loading of Mechanochemically Active Polymer Coatings," *ACS Applied Materials & Interfaces*, 6, 5350-5355, (2014).
    d. **Grady**, M. E., Geubelle, P. H., Sottos, N. R., "Interfacial Adhesion of a Photodefinable Polyimide on Passivated Silicon," *Thin Solid Films,* 552, 116-123, (2014).

2. The interdependence of cell elasticity and cytoskeletal components is a critical step toward understanding the mechanics of living tissue. Cellular responses and their microarchitecture react and adapt to their environment and disease state. Changes in cell elasticity have been implicated in the pathogenesis of many human diseases including vascular disorders, malaria, sickle cell anemia, arthritis, asthma, and cancer. Therefore, there is a practical need to measure cell mechanics quantitatively to understand how diseased cells differ from healthy ones. In particular, investigating the mechanical properties of cancer cells may help to better understand the physical mechanisms responsible for cancer metastasis. I utilized Atomic Force Microscopy to evaluate the mechanical properties of healthy and diseased cells subject to cytoskeletal destabilizers.
    a. **Grady,** M. E., Composto, R. J., Eckmann, D. M., "Cell elasticity with altered cytoskeletal architectures across multiple cell types," *Journal of Mechanical Behavior of Biomedical Materials,* 61, 197-207, (2016).
    b. Caporizzo, M. A., Rocco, C., Coll Ferrier, C., **Grady**, M. E., Parrish, E., Eckmann, D. M., Composto. R. J., "Strain-rate Dependence of Elastic Modulus Reveals Silver Nanoparticle Induced Cytotoxicity," *Nanobiomedicine*, 2: 9, (2015).

Complete List of Published Work in Google Scholar:
https://scholar.google.com/citations?user=aF08vboAAAAJ&hl=en

Research Website:
Grady Lab http://www.grady.engineering.uky.edu/