Dear Colleagues,

We invite you to submit a paper to the **2019 Society for Experimental Mechanics (SEM) Annual Meeting** in one of the many sessions in the **Fatigue and Fracture Track**. See below for further information on these sessions, and please forward this to others who may be interested.

The conference will be held in **Reno, Nevada** from June 3-6, 2019. **Abstracts are due October 17, 2018** via the SEM website. General submissions are always welcome. **When submitting your abstract for a specific session please enter the name of the session on the abstract submission form.** Also please email a copy of your abstract to the session organizer directly.
Conference Website: https://sem.org/annual

SEM General Call for Papers: https://sem.org/files/events/19s/19s-CallforPapers.pdf

The abstract submission link is: https://sem.org/annualauthor (click "Abstract Submission" button)

Although SEM encourages the submission of full conference papers or extended abstracts, **oral-only presentations are welcome in the following sessions**.

We are looking forward to seeing you at SEM in 2019!

SEM Fracture and Fatigue Session Organizers:
Shuman Xia Allison Beese Ryan Berke Garrett Pataky
Jay Carroll Kavan Hazeli Siva Nadimpalli Scott Grutzik
Onome Scott-Emaukpor Omar Rodriguez Shelby Hutchens
Bala Sundaram Bikramjit Mukherjee Will LePage Behrad Koohbor

1. In Situ Techniques and Microscale Effects on Mechanical Behaviors
Organizers: Jay Carroll, Omar Rodriguez, Shelby Hutchens
Email: jcarrol@sandia.gov, omar.l.rodriguez@nasa.gov, hutchs@illinois.edu
2. Fatigue and Fracture under Extreme Environments (*In collaboration with Thermomechanical TD and Time Dependent Materials TD)*
Organizers: Ryan Berke, Kavan Hazeli,
Email: ryan.berke@usu.edu, kavan.hazeli@uah.edu
3. Mechanics of Energy Materials
Organizers: Shuman Xia, Siva Nadimpalli, Will LePage, Behrad Koohbor
Email: shuman.xia@me.gatech.edu, nadimpal@njit.edu, wlepage@umich.edu, koohbor@illinois.edu
4. Fracture and Fatigue of Composites *(In collaboration with composites TD)*
Organizers: Kavan Hazeli
Email: kavan.hazeli@uah.edu
5. Vibration Effects and High Cycle Fatigue in Fracture and Fatigue
Organizers: Ryan Berke, Onome Scott-Emuakpor
Email: ryan.berke@usu.edu, onome.scott-emuakpor.1@us.af.mil
6. Fracture and Fatigue in Additive Manufacturing *(In collaborations with Additive Manufacturing track)*
Organizers: Allison Beese, Garrett Pataky
Email: amb961@psu.edu, gpataky@clemson.edu

7. Interfacial and Mixed-Mode Fracture
Organizers: Scott Grutzik, Bala Sundaram
Email: sjgrutz@sandia.gov, meenakshb@corning.com
8. Integration of Models and Experiments
Organizers: Bikramjit Mukherjee, Scott Grutzik
Email: bmukherjee1@dow.com, sjgrutz@sandia.gov
9. Fracture and Fatigue in Glass and Ceramics
Organizers: Bala Sundaram, Scott Grutzik
Email: meenakshb@corning.com, sjgrutz@sandia.gov
10. Fracture and Fatigue of Soft Materials and Gels
Organizers: Bikramjit Mukherjee, Shelby Hutchens
Email: bmukherjee1@dow.com, hutchs@illinois.edu

1. In Situ Techniques and Microscale Effects on Mechanical Behaviors
Organizers: Jay Carroll, Omar Rodriguez, Shelby Hutchens
Email: jcarrol@sandia.gov, omar.l.rodriguez@nasa.gov, hutchs@illinois.edu

In situ techniques provide a wealth of information for the understanding of fatigue and fracture mechanisms and behavior. Techniques including in situ digital image correlation (DIC) with optical or scanning electron microscope imaging, in situ neutron diffraction, in situ synchrotron imaging, and tomography can allow for the observation and identification of failure mechanisms across a wide range of length and time scales. The usefulness of in situ experimental data has been recognized and is becoming the standard for validation of models and qualification of components.

Deformation and fracture involve processes at the atomic and molecular length scales. However, deformation and fracture have been approached historically on length scales that tend to homogenize the material, due to a lack of small-scale interrogation tools. Over the past decade, the application of modern tools for the fabrication and interrogation of materials and structures at the micron size scale and below is revolutionizing mechanics. It is now possible to measure the mechanical behavior of structures with dimensions well below one micron, where surface effects and microstructure become critical. In larger scale structures, deformations can be captured at nanometer size scales, allowing for the measurement of strains in separate grains, or in separate phases of a material, as a crack progresses or damage accumulates.

This symposium will bring together researchers using in situ and/or small scale experimental techniques to address common mechanics issues. In addition to fatigue and fracture, experiments on other topics, such as plasticity, creep, dynamic effects, and engineering development, are welcome. Novel experimental methods, studies linking size scales, and studies linking experiments to theory or simulation are particularly sought.

2. Fatigue and Fracture under Extreme Environments (*In collaboration with Thermomechanical TD and Time Dependent Materials TD)*
Organizers: Ryan Berke, Kavan Hazeli
Email: ryan.berke@usu.edu, hazeli@jhu.edu

This session is intended to provide a forum for researchers from the academic, industrial and government sectors to share, discuss, and debate the latest improvements on the science, technology, and application fronts in fatigue and fracture under extreme environments. Of particular interest is to develop an understanding of material behavior under extreme conditions that include but not limited to cyclic loading, photonic and phononic interactions, elevated temperatures, highly corrosive environments, high radiation fluxes or a multitude of above factors.

The goal is to investigate the constitutive response and roles of evolving intrinsic field variables to provide kinematic, kinetic and dynamic descriptions of the way cracks nucleate and propagate through solids.
Abstracts are solicited in (but not limited to) the following topics:

- Fatigue strength and resistance under extreme environments
- Quantitative and/or qualitative relationships between micro-macro environments and fatigue properties along with life prediction under extreme environments
- Thermal and thermomechanical fatigue
- Photonic and phononic material response
- Dynamic fatigue
- High cycle fatigue
- Creep fatigue and/or creep rupture
- Microstructure evolution and stability

3. Mechanics of Energy Materials
Organizers: Shuman Xia, Siva Nadimpalli, Will LePage, Behrad Koohbor
Email: shuman.xia@me.gatech.edu, nadimpal@njit.edu, wlepage@umich.edu, koohbor@ilinois.edu

Energy materials hold one of the keys to fundamental advances in generation, storage, conversion, absorption, and harvesting of energy for a broad range of automotive, industrial and defense applications. The successful development and deployment of these materials relies critically on a fundamental understanding of strongly coupled multiphysical phenomena, including mechanical deformation, heat and mass transfer, phase transformation, electromagnetism, and chemistry. The objective of this symposium is to provide a forum for the presentation and discussion of experimental and integrated computational/experimental investigations in this highly interdisciplinary field. The symposium will cover the latest research advances from the mechanics and materials prospective and will seek to identify new research challenges by exploring interfaces with other disciplines. Suggested topics include but are not limited to: in-situ and ex-situ experimental characterization of coupled phenomena between mechanical and other physical processes, microstructure/property relationships, phase transformation in energy materials, multiscale characterizations, and integrative experimental and modeling approaches.

4. Fracture and Fatigue of Composites *(In collaboration with composites TD)*
Organizers: Kavan Hazeli
Email: kavan.hazeli@uah.edu

Difficulties in predicting and controlling fracture and failure in composite systems impose challenges for successfully integrating new composites and multifunctional materials in engineering structures. Therefore, there is a critical need to develop reliable methodologies to quantify and predict structural response and strength under various static and dynamic loadings, as well as in severe environmental conditions. This session welcomes contributions in all fields related to experimental investigations and computational modeling relevant to damage precursors, fracture and failure processes in composite and multifunctional materials. The goal is to investigate the role of evolving intrinsic field variables to provide kinematic, kinetic and dynamic descriptions of the way cracks nucleate and propagate through composite systems. Abstracts are solicited in (but not limited to) the following topics:

- Failure and instabilities in composite and heterogeneous systems

- Fracture and damage identification and quantification
- Fatigue of composite materials: damage mechanisms and fatigue life
- Experimental observation of crack nucleation and propagation at different length scales
- Dynamic Loading of composites: impact, shock, crash, and blast
- Mechanical response of hybrid materials and structures
- Functionality of multifunctional and smart composites
- Damage prediction, prevention, and NDE in composite systems

5. Vibration Effects and High Cycle Fatigue in Fracture and Fatigue

Organizers: Ryan Berke, Onome Scott-Emuakpor
Email: ryan.berke@usu.edu, onome.scott-emuakpor.1@us.af.mil

High Cycle Fatigue (HCF) is important for many engineering applications, such as gas turbine engines and other rotating machinery. In order to ensure the performance, safety, and reliability of such assemblies, materials must be characterized to withstand HCF under relevant operating conditions. However, HCF experiments can be costly and time-consuming -- a single axial fatigue test operating at 40 Hz requires almost 70 hours to accumulate enough cycles (on the order of 10^7) to generate a single point on an S-N Curve. Compared to axial test methods, vibration-based methods can not only better reproduce the operating environments of high cycle machinery, but can be conducted at much higher frequencies and thus accumulate HCF data more quickly. In this symposium, abstracts are sought which explore the use of vibration-based methods in experimental mechanics, and/or new advances in HCF characterization. Topics may include, but are not limited to, use of computational approaches, statistical models, experimental methods, and/or error quantification.

6. Fracture and Fatigue in Additive Manufacturing *(In collaborations with Additive Manufacturing track)*

Organizers: Allison Beese, Garrett Pataky
Email: amb961@psu.edu, gpataky@clemson.edu

Additive manufacturing (AM) of metals, polymers, and ceramics enables the layer-by-layer fabrication of complex geometries that cannot be fabricated through traditional techniques, as well as the fabrication of custom components, and the repair of existing parts. However, the processing of components by AM varies drastically from traditional processing techniques. For example, AM typically involves thermal cycles not seen in conventional processing, resulting in microstructures and properties that widely vary from traditionally-manufactured counterparts. Therefore, in order to open the application space for, and wider adoption of AM, an understanding of the processing, structure, and mechanical property relationships is required. In this symposium, we seek experimental and computational studies that link processing to structure, and/or structure to mechanical properties in materials made by AM, including, but not limited to, metals, polymers, and ceramics.

7. Interfacial and Mixed-Mode Fracture

Organizers: Scott Grutzik, Bala Sundaram
Email: sjgrutz@sandia.gov, meenakshb@corning.com

Many engineering designs involve interfaces between different materials. These interfaces can act as flaws resulting in failure that initiates at or propagates along them. Analysis of such interfacial failures are extremely complex. Depending on the relative toughness between the bonded materials, interfacial toughness and its orientation, the crack may be restricted to or can kink out of the interface. Under certain conditions, the crack may even branch into multiple

cracks at the interface. Measurement of interfacial toughness for wide range of mode-mixities is essential as a constrained crack often propagates along an interface under varying mode-mixity. This makes the characterization and analysis of interfaces significantly more challenging than bulk materials, which are often characterized by their mode-I (opening mode) toughness. This session will focus on interfacial fracture phenomena such as mode-mixity, cohesive/adhesive failure, traction separation laws, crack kinking, unique specimen geometries, mixed-mode fracture, crack branching at an interface, interfacial toughness along with interfacial fatigue for both quasi-static and dynamic loading conditions.

8. Integration of Models and Experiments

Organizers: Bikramjit Mukherjee, Scott Grutzik
Email: bmukherjee1@dow.com, sjgrutz@sandia.gov

Models and experiments have much to learn from one another. The integration of these two disciplines at all scales, promises to accelerate our understanding of fracture and fatigue, and related phenomena. This will be important for designing future materials with enhanced fracture resistance and for designing structures that fully exploit these properties. To foster further interaction of experiments and modeling, this session will provide a venue for work emphasizing the integrating and validating models with experiments. The phenomena discussed will include mechanical behavior of materials such as fatigue, fracture, plasticity, creep, etc. Expected topics will include novel combined modeling/experimental techniques, different approaches to model validation, and work in which models and experiments inform one another. This session will bring together researchers from a number of fields in including crystal plasticity; fatigue crack growth; fracture and ductile failure; and effects of combined mechanical loading and extreme environments such as corrosion, elevated temperatures, hydrogen embrittlement, and radiation effects. Presentations with a wide range of backgrounds from basic research to engineering development are welcome.

9. Fracture and Fatigue in Glass and Ceramics

Organizers: Bala Sundaram, Scott Grutzik
Email: meenakshb@corning.com, sjgrutz@sandia.gov

Brittle materials such as glass and ceramics with their high stiffness, high hardness and low failure strains pose significant challenges for their fracture study. Although these attributes have led to them being used widely for various engineering applications, unlike other materials, their strength is not an intrinsic property but rather dependent on the flaw distribution. Glass is very much susceptible to static fatigue - the duration of the application of the loading influences the strength of glass - especially in high humidity environment. Ceramics on other hand exhibit cyclic fatigue. Then there exists glass-ceramics, which is a material system with both amorphous and crystalline phase. With rapid advancement in computational capabilities, some of these complex behaviors can be simulated numerically. Other brittle glassy materials, apart from inorganic glasses and ceramics, that show similar characteristics are also welcome in this session. This session aims to connect several interesting topics such as stress corrosion, static fatigue, slow crack growth, indentation and scratch, fast fracture, crack branching, characterization techniques and specialized test methods, cyclic fatigue, transformation toughening, R-curves etc. - be it computational or experiment based.

10. Fracture and Fatigue of Soft Materials and Gels

Organizers: Bikramjit Mukherjee, Shelby Hutchens
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In contrast to high-load structural applications, soft materials find use when engineering designs require large deformations and high compliance. Though these properties enable protective, conformable, or biocompatible designs, they pose challenges in failure characterization. Material fragility may prevent the use of standard fracture geometries and testing procedures. Measurement of the large deformations requires advanced strain field characterization techniques (e.g., particle tracking, large deformation DIC, light scattering). Difficulties arise when attempting to apply linear elastic fracture mechanics framework to characterize fracture of soft materials and structures. Besides, instabilities associated with interfacial (e.g. viscous/elastic finger formation) and bulk fracture (e.g., cavitation or fracture) of soft materials have become a rich area of experimental and theoretical research providing unique avenues to engineer bio-mimetic properties. In addition, many soft materials, including elastomers, gels, foams, and biological tissues, possess properties that are highly sensitive to environmental conditions (e.g., temperature, humidity). Somewhat uniquely, the solution-like nature of many soft materials enable the use of molecular sensors (e.g., mechano-chemistry) to probe the nature of micro structural contributions to failure processes. Abstracts are solicited on the above or related topics relevant to the characterization of soft fracture.