

# Characterizing Elastomer Fatigue Behavior for Analysis and Engineering

Elastomers are outstanding in their ability to repeatedly endure large deformations, and they are often applied where fatigue performance is critical. Their macromolecular structure gives rise to unique behaviors, and so appropriately specialized experimental methods are needed to characterize, analyze, and design for durability. This 3-day course will give you powerful approaches to anticipate, diagnose and solve fatigue-related issues.

## Course Objectives

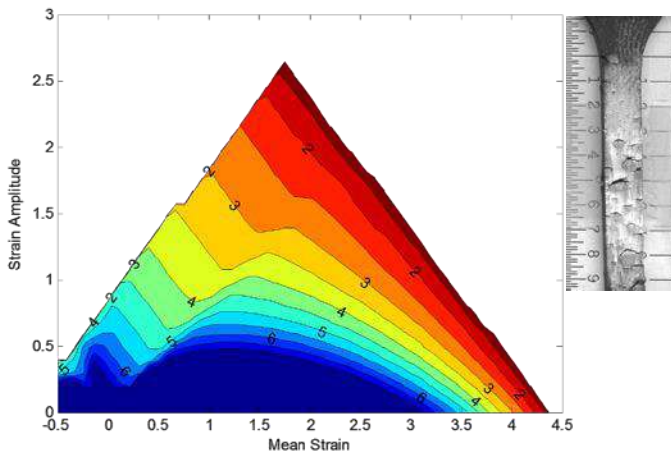
- Know the physics and factors that govern rubber's fatigue behavior
- Use accurate models and efficient procedures to characterize fatigue behavior
- Take advantage of test strategies that minimize risk and maximize productivity
- Use crack nucleation and fracture mechanics approaches effectively
- Use characterization to inform accurate fatigue calculations
- Use characterization to diagnose and solve development issues

## Format

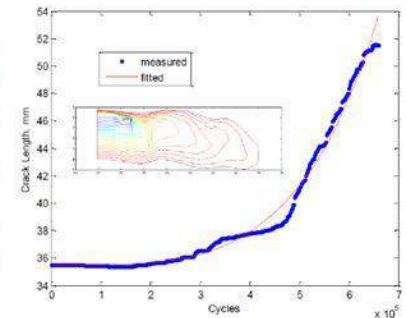
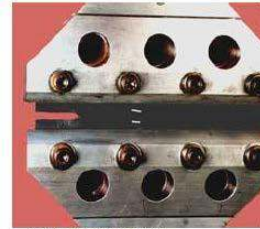
The course includes lectures, live lab demos, and hands-on exercises focused on processing and interpreting experimental measurements of fatigue behavior. Lunch, snacks, and dinner on Day 1 included.

## Instructor

Dr. Will Mars is an international authority on damage mechanics in elastomers. He brings two decades of experience developing product testing and simulation methods in the rubber industry. He is the editor of *Rubber Chemistry & Technology*.



Haigh diagram for a natural rubber compound, showing contours of equal fatigue life.



## Agenda

Day 1: 8:30 – 4:45 pm, 6 pm Course Dinner

- Elastomers as engineered materials
- Design, Analysis and Characterization for Durability with Rubber
- Stiffness, mode of control, compound optimization
- Stress-strain – molecular origins and hyperelasticity
- Stress-strain – cyclic phenomena and advanced models
- Self-heating in rubber
- Tearing energy

Day 2: 8:15 – 4:45 pm

- Characterizing strength of rubber
- The fatigue threshold
- Strategic considerations in fatigue testing
- Characterizing Fatigue behavior of individual cracks – fully relaxing cycles
- Characterizing Fatigue behavior – nonrelaxing cycles and strain crystallization
- Crack nucleation, S-N curves, Continuum Damage

Day 3: 8:15 – 3:00 pm

- Characterizing crack precursor size
- Rubber's Fatigue Design Envelope
- Aging
- Multiaxial loading and Critical Plane Analysis
- Fatigue in tension, shear, and compression
- Variable amplitude loading, Rainflow counting, and damage accumulation
- Component testing

## Registration Form: Characterizing Elastomer Fatigue Behavior for Analysis and Engineering

Course Dates: \_\_\_\_\_ Course Location: Axel Products, Inc., **Ann Arbor, Michigan**

Price: \$2500\*

\*for registrations received prior to COB 14 days prior to course begin date. Registration after this date incurs a late fee of \$250.

Mail or e-mail this form to:

Attention: Joe Suter, [jasuter@endurica.com](mailto:jasuter@endurica.com)

567-301-0464

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Findlay, Ohio 45840

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Street Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Work Phone \_\_\_\_\_

Email \_\_\_\_\_

Any food or other preferences (veggie?) \_\_\_\_\_

Payment Method:

PO No. \_\_\_\_\_ Credit Card Type:  VISA  MasterCard  American Express

Card No. \_\_\_\_\_ Card CVV No. \_\_\_\_\_

Cardholder Name \_\_\_\_\_ Exp. Date \_\_\_\_\_

Card Billing Street Address \_\_\_\_\_

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Or, write a check payable to Endurica LLC.

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Participant cancellations must be received at least 10 working days in advance. Registrations canceled by participants less than 10 working days before the training course begins are subject to a 50% cancellation charge. For cancellations occurring on the first day of a scheduled training course, and for "no shows," the full tuition fee is non-refundable.