FATIGUE PROPERTY MAPPING

KNOW YOUR MATERIAL

MATERIAL CHARACTERIZATION

Endurica's Fatigue Property Mapping™ service provides a comprehensive inventory of the fatigue capabilities of your material. Get Durability Right® in your development and analysis projects with our uniquely efficient, reliable, and physics-based testing protocols.

BENEFITS

- Material parameters ready to use with durability simulation codes, including Endurica CL™, Endurica DT™, Endurica EIE™, and fe-safe/Rubber™
- Full support for both nucleation (ε-N) or (σ-N) and crack propagation (da/dN) analysis methods.
- Accurate and timely results via uniquely reliable and productive test strategies.
- Reduced risk and cost of development iterations when you take your material's fatigue capabilities into account.
- Leverage your material's full potential by properly aligning its capabilities with the application's demands.

Hyperelastic Module
Simple, planar, and equibiaxial tension, Mullins effect

FPM H

Core Fatigue Module
Fully relaxing behavior from both nucleation and fracture mechanical perspectives

FPM C

Intrinsic Strength Module
Quantify endurance limits

FPM IS

Non Relaxing Module
Quantify strain crystallization, minimum and mean strain effects

FPM NR

Ageing Module
Quantify endurance limit, estimate ageing rate of stiffness, intrinsic and ultimate strength

FPM AB

FPM AM MASTER CURVE

Oxygen Diffusion Module
Aerobic Effects on Ageing

FPM O2A ADV

FPM O2B BASIC

Ozone Module
Quantify ozone attack critical energy and rate

FPM O3

Thermal Modules
Quantify dissipative properties, thermal properties

FPM TB BASIC — BASIC

FPM TA ADV — ADVANCED

FPM TM K/WLF — K/ WILLIAMS-LANDEL-FERRY

Cyclic Softening Module
Quantify cyclic softening effects

FPM S

Reliability Module
Weibull statistics for strength and crack precursor size populations

FPM R

Creep Module
Creep crack growth rate effects

FPM CR

Chip & Cut Module
Chip, chunk and cut testing for wear

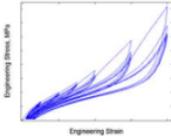**FPM CC**

Endurica
Get Durability Right®

GET DURABILITY RIGHT® WITH ENDURICA'S FATIGUE PROPERTY MAPPING

Hyperelastic Module
FPM H

Provides basic information needed for Finite Element Analysis and initial transient softening (Mullins effect)
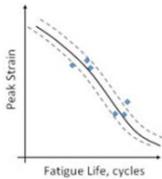- Simple tension
- Planar tension
- Biaxial tension

Core Fatigue Module
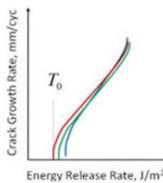**FPM C**

Pre-requisite for any fatigue analyses
- Provides basic fatigue crack growth rate curve
- Strain-life curve
- Crack precursor size

Intrinsic Strength Module
FPM IS

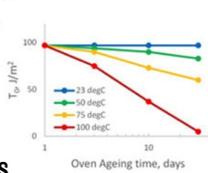Required for safety factor / infinite life / fatigue limit analysis
- Recommended for cases with fatigue life longer than 10^6 cycles

Ageing Module
FPM AB **FPM AM MASTER CURVE**

Recommended for cases with fatigue life longer than 10^6 cycles, and when ageing must be taken into account
- Quantify evolution of stiffness and crack growth parameters
- Quantify Arrhenius Ageing Law parameters

Thermal Modules
FPM TB BASIC **FPM TA ADV** **FPM TM K/WLF**

Quantify dissipative / thermal properties, temperature dependence
- Basic module for cases involving signficant self-heating or thermal gradients
- Advanced module for improved accuracy in structural and heat transfer analyses
- Thermal Effects module (K/WLF) used to determine strain, temperature and frequency dependence of viscoelastic storage and loss modulus

Non Relaxing Module
FPM NR

Recommended for cases where cyclic minimum loading is greater than zero and material may strain crystallize
- Test is run under range of nonrelaxing (R>0) conditions
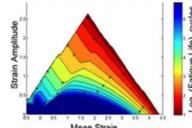
Ozone Module
FPM O3

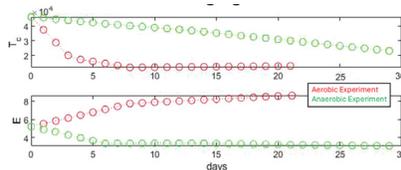Quantify ozone attack critical tearing energy and rate
- Required when rubber is susceptible to ozone attack and operating in environment with ozone

Oxygen Diffusion Module
FPM O2B BASIC **FPM O2A ADV**

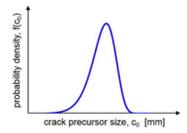Recommended when the potential for aerobic effects on ageing should be checked
Use with
- Fick's law mass diffusion
- Gillen et al's basic autooxidation scheme

Reliability Module
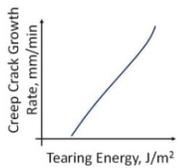**FPM R**

Recommended when probability of failure needs to be estimated
- Weibull analysis parameters relating frequency of occurrence to size of crack precursor

Creep Module
FPM CR

Recommended for cases involving long periods under static load
- Time-dependent crack growth is characterized here (rather than cycle-dependent crack growth)

Cyclic Softening Module
FPM S

Recommended for cases where stiffness loss limits durability
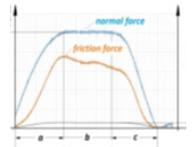- Use with Endurica DT cosimulation feature
- Displacement control experiment records the evolution of the peak stress with cycles
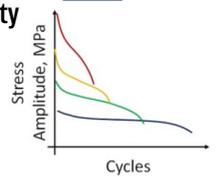
Chip & Cut Module
FPM CC

Recommended for cases where harsh or abrasive environments may cause cutting and chipping on an elastomeric contact surface
Use with
- Tire tread applications
- Belts - especially in mining
- Impact damage applications