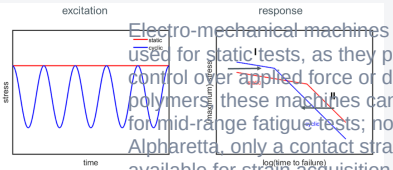
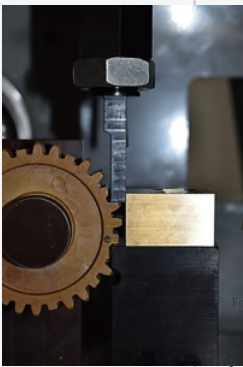


Fatigue

APPLICATIONS		THEORY, KNOWLEDGE, & MODELS		CAPABILITIES	
Thermal shock (busbars)		Introduction to Fatigue (why does material respect SN ?) Difference between Fatigue and Creep CTD presentation - March'26 VE presentation (more detailed) - March'26 Definition and notations		Basics about Fatigue tests List of Fatigue data available, SSP Upload Fatigue data (systematically linked to material center)	
	Thermal Shock on Demonstrator Grades prioritized for Thermal Shock characterization	Physical Background		• Core Labs Capabilities Electro-mechanical machines are generally used for static tests, as they provide better control over applied force or displacement. For polymers, these machines can also be used for mid-range fatigue tests; note that at Alpharetta, only a contact strain gauge is available for strain acquisition. 	
Gears		Influence of Various Factors on Lifetime or σ_a Vs N_f, Influence of Factors on Lifetime Fiber Orientation: 90° Loading Ratios, $R_{eff} \leftarrow R_{eff} \rightarrow -1$ Temperature: 150°C $\leftarrow$ -40°C Corner Radius: R2.5 mm $\leftarrow$ R0 mm w Weld lines $\leftarrow$ w/o Weld lines Frequency: High $\leftarrow$ Low Hz		Effect of Fiber orientation Effect of Temperature Effect of Humidity Effect of Mean Stress / Equating Ratio Effect of Frequency Effect of Weld lines Effect of Sharp Edge Effect of Over molding Effect of Recycled fibers Effect of ageing Effect of Harsh environments (Chemical, ...)	
	Single tooth Bending tests	Note: In case of σ_{max} Vs N_f, the effect of Loading Ratio is reversed		Contacts: Alpharetta: Smith Colter; Bollate: Davide Savoni, Luigi Giraldi ; Shanghai: Li Hanson; Tokyo: Toshio Hatayama	
Metal to plastic applications		• Bikes: Frames, Handle & Fork • Coffee machine handles		• Corporate Capabilities Creep-Fatigue interactions, Self-heating at high frequency Multiaxiality, Maximal Loading Shape Numerical: Effect of Mesh size, Effect of Mesh type Empirical law	
	Compressor	High Frequency Fatigue loadings		At the Brussels site, in-house developed demonstrator parts and testing setups enable us to conduct fatigue bending tests on L-shaped samples with various radii and on different approaches with or without ribs and weld lines.	
	Identified cases for the year 2025	Life prediction methodologies		Stress based approach Energy based approach	
		Fatigue modeling of fiber reinforced polymers		Region Equipment Load Tem max min	

Workflow	Life time prediction for cyclic loading	3x Servo-hydraulic machines (DIC, Extenso)	10kN	-40
	Life time prediction for thermal cyclic loading	Composite testing	100kN	-80
Validation	Contacts: Michel Houba, Dominique Delcourt			

• ADL Capabilities

Although tooth bending is not a classic fatigue test, this can be used to validate the FE models, with capacity to test higher frequencies.

Tips: The current FE model for fiber filled polymers, can be applied only if the failure mode is slow crack growth controlled failure or brittle failure, which typically occurs at the root of the teeth in gear tooth bending.

Region	Equipment	Load	Tem
		max	min
Bollate	Gear tooth bending		ai

Contacts: Matilde Scurria, Lorenzo Mancin

• Potential external partners

Syensqo has engaged Leartiker to generate fatigue test data (including hysteresis measurements), to support the creation of [Digi mat fatigue cards](#) across different temperatures. Other capabilities include [sample molding](#), [creep analysis](#), [advanced...](#)

Laboratory	Equipment	Load	1
		max	
Leartiker, Spain	Electro-mechanical MTS Insight 100 (2D & 3D)	100kN	
	Servo-hydraulic machine MTS Bionix, +Torsion	15kN	
	Metravib DMA +300, +2000	2kN	

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