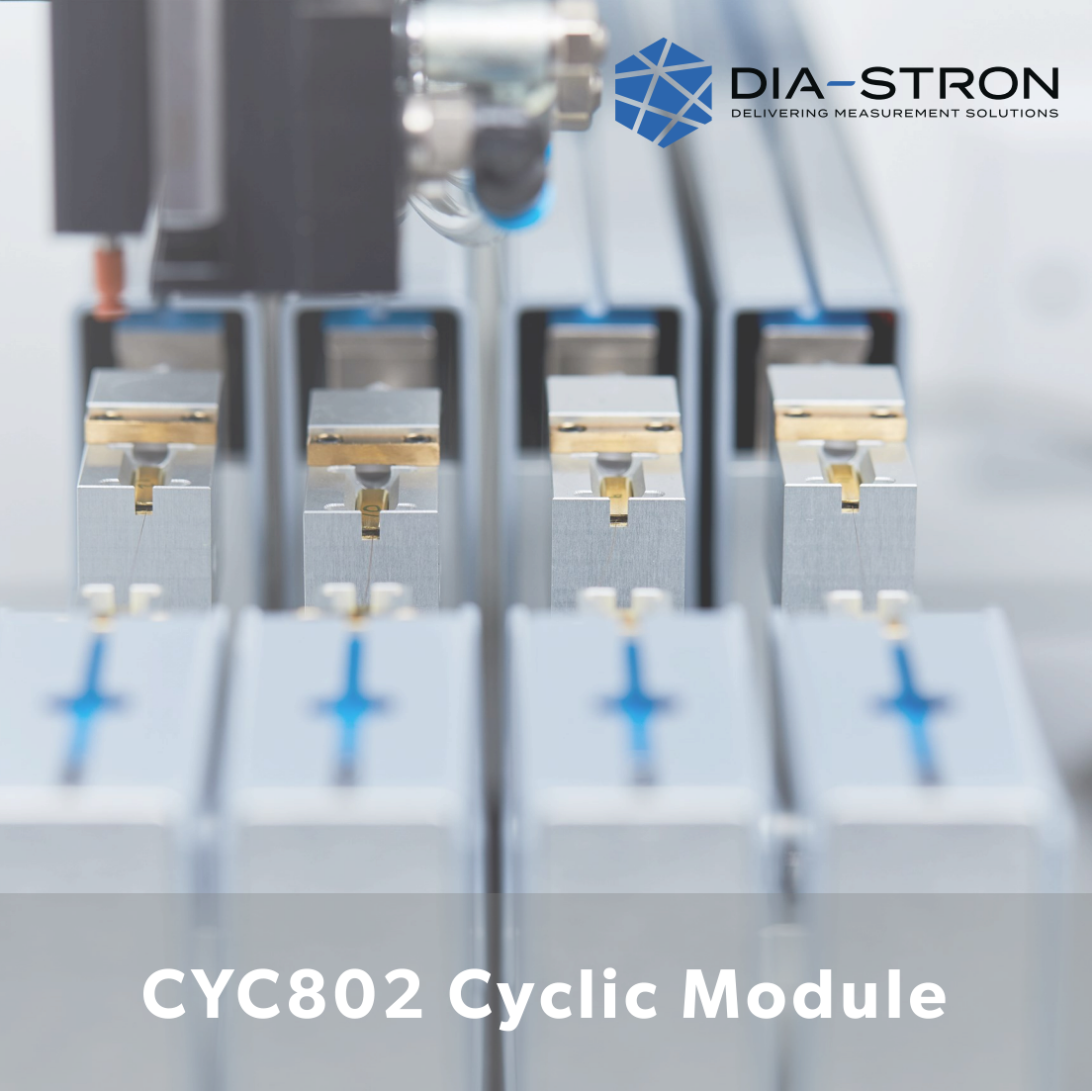
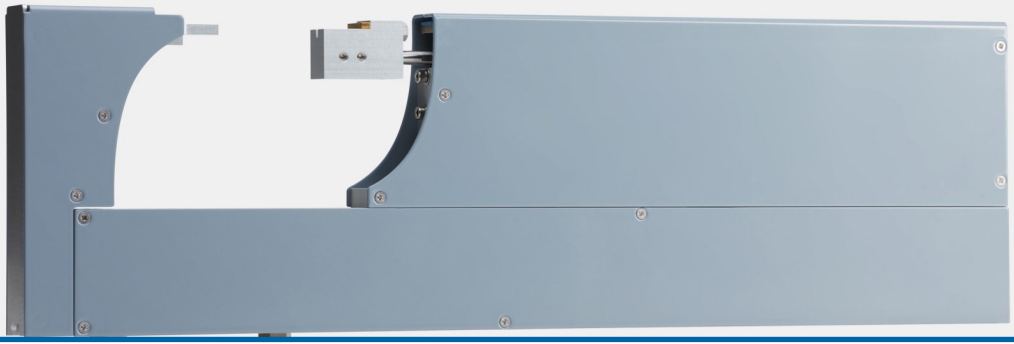



# CYC802 Cyclic Module



## Overview

The CYC802 Cyclic Tester simulates a realistic approach to everyday hair grooming by subjecting fibres to repeated cyclic tensile deformations until failure. Data analysis from the CYC802 shows greater differences between samples than conventional tensile stress/strain experiments.

Principal benefits:

- High throughput testing
- High capacity: 50 fibre linear cassette, up to 4 cassettes in a cassette hotel
- Automated operations and analysis
- Up to 4 cyclic modules can be integrated on an automated platform
- Multi-tasking allows for simultaneous measurement, reducing resting time

Applications and claims:

- Fatigue testing using repeated strain, force or stress
- Hair root vs tip survival analysis
- Impact of hair treatments
- S-N curves

**Metrology principle —**

The CYC802 fatigue tester is designed around a voice-coil drive which repeatedly brings the sample to a pre-determined strain, force or stress. The sample is mounted using Dia-Stron brass crimps and placed within two sample pockets. With the fibre dimensions already captured, the CYC802 brings the sample to a pre-set force before starting the fatigue measurement. Various factors contributing to fibre failure are: presence and propagation rate of flaws depending on ethnicity, chemical or physical damage, grooming regime and environmental factors such as UV exposure.

**Dedicated software – UvWin**

The CYC802 system is controlled using Dia-Stron UvWin software. Parameters for these methods can be easily edited within the software. UvWin enables automatic data correction for system compliance.

UvWin also offers a number of integrated data processing tools and the raw data can be exported as a text file, for use in Excel or other statistical packages. UvWin is compatible with the latest versions of the Windows OS.

# Sample data and analysis —

Figure 1: First cycle

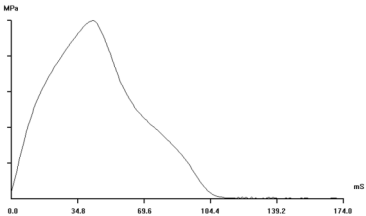
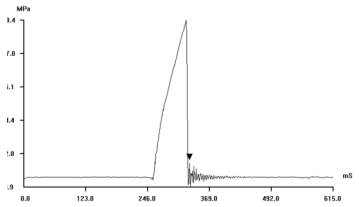
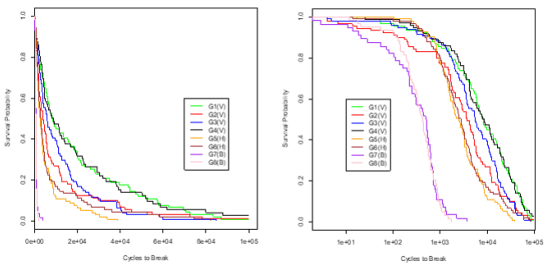
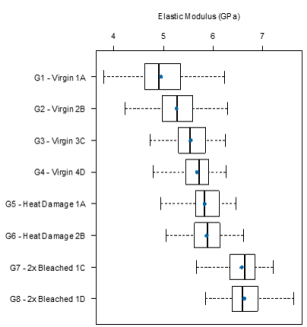



Figure 2: Failure cycle

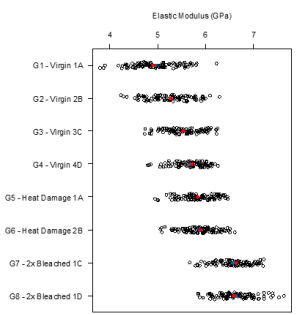



*Kaplan-Meier plot using a linear x-axis (left) and a logarithmic x-axis (right).*




*Boxplots of elastic moduli.*
***Blue** dots represent **means**.*




*Scatterplots of elastic moduli.*
***Blue** dots represent **means**.*
***Red** dots represent **medians**.*

## References —


Publications:

Marsh JM., Mamak M., Wireko F., Lebron A., Cambron T., Huber T., David IN., Williams REA. and McComb DW. (2018): "Multimodal Evidence of Mesostructured Calcium Fatty Acid Deposits in Human Hair & Their Role on Hair Properties"; ResearchGate, September 2019

Everaert EPJM., Zhang S., Tran D., Kroon B., Zhang G., Thompson B. and McMullen RL. (2015): "Strengthening the Hair Fiber from Within: Repairing the Cortex of Damaged Hair"; IFSCC Conference, Zurich 2015

Evans TA. (2009): "Fatigue testing of hair—A statistical approach to hair breakage"; Journal of Cosmetic Science, 2009, 60, 599-616

Examples of use in patent claims:

US20170007518A1 Method of strengthening hair fibers and protecting dyed hair color from fading or wash-out (Ashland) May 2019

Uses for claims in technology advertising:

- Ashland
- Evonik

| CYC802 Module | |
|---|---|
| Extension range | 28-50mm |
| Speed range | 1-100mm/sec |
| Force range | 0 to 20N (2000gmf) |
| Force resolution | 0.05gmf |
| Displacement resolution | 10µm |
| Dimensions (LxWxH) | 445x20x130mm |
| Weight | 2.25kg |
| **Programmable Features** | |
| Methods | Constant force<br>Constant strain<br>Constant stress<br>S-N curve |
| **Content** | |
| UV1000<br>PU1100<br>CYC802 module<br>USB and power cables<br>UvWin software for Windows OS | |
| **Requirements** | |
| Power supply | Universal<br>85-265V AC<br>47-63Hz, 100W |
| Computer | Windows OS: 7 and 10<br>1 x USB port |

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