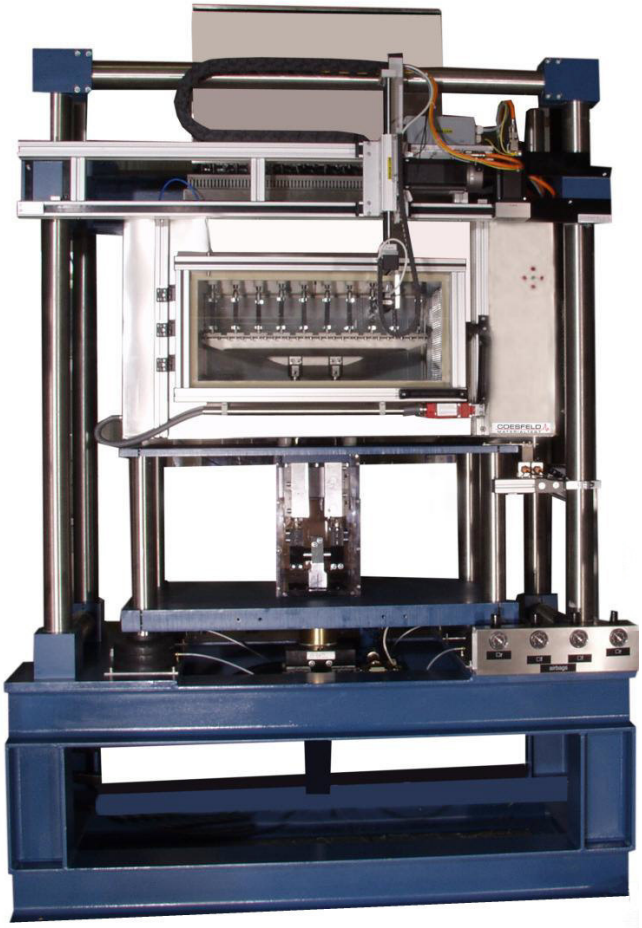
The more intelligent solution ...

COESFELD MATERIALTEST

Tear Analyser System BAYER



The more intelligent solution ...

Coesfeld GmbH & Co. KG
Tronjestraße 8, 44219 Dortmund
Tel.: +49 231 912980 0
Fax.: +49 231 179855
www.coesfeld.com
mail@coesfeld.com

Product Information

Introduction

An important criterion in the assessment of dynamically loaded rubber like materials is their resistance to crack growth, fatigue and ageing. These properties are influenced not only by the choice of polymer, filler and cross linking system but also to a high degree by type and amounts of the chemicals that are added to inhibit fatigue and ageing. Commercial methods for ascertaining the fatigue resistance of elastomers have so far been restricted to measurement of a test specimen's time to failure (Monsanto Fatigue-to-Failure tester, Martens apparatus, different kinds of flexometers) or to those in which the testing procedure is interrupted and the degree of damage appraised visually and entirely qualitatively as a function of the integral load (De-Mattia test). [1] The Tear Analyser system is an instrument, which allows a quantitative analysis of crack growth processes.

History and Development

The Tear Analyser system has a history of more than 20 years. The first generation has been developed by Bayer. The models have been continuously improved and adapted to modern machine standards.

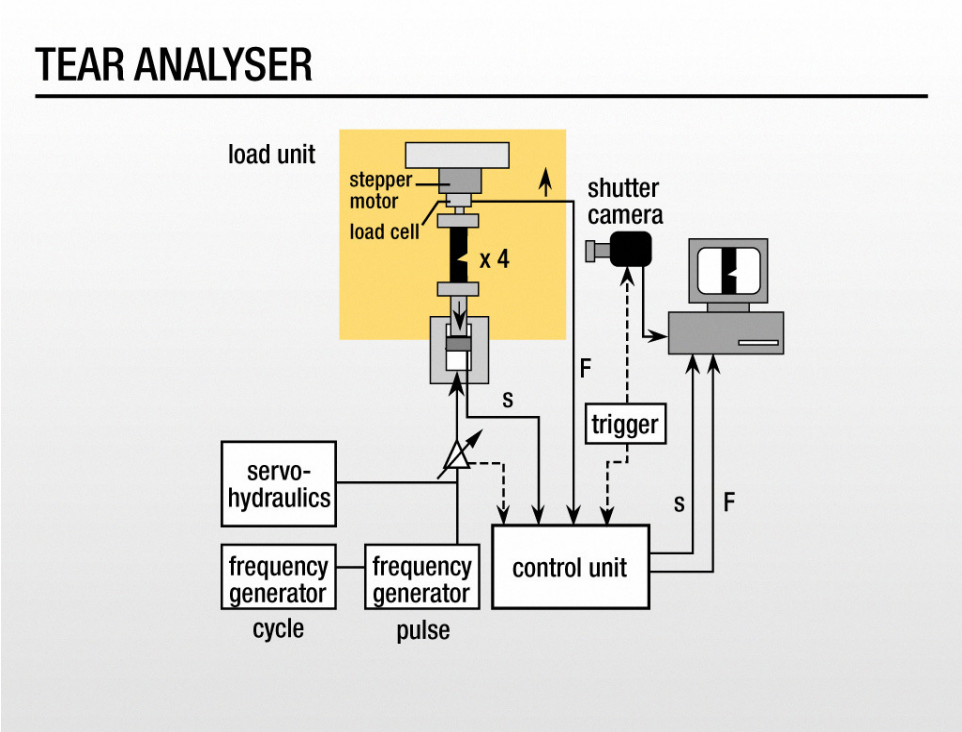
Middle 1990th Model

Topical 2010th Model

System functionality

Apparatus

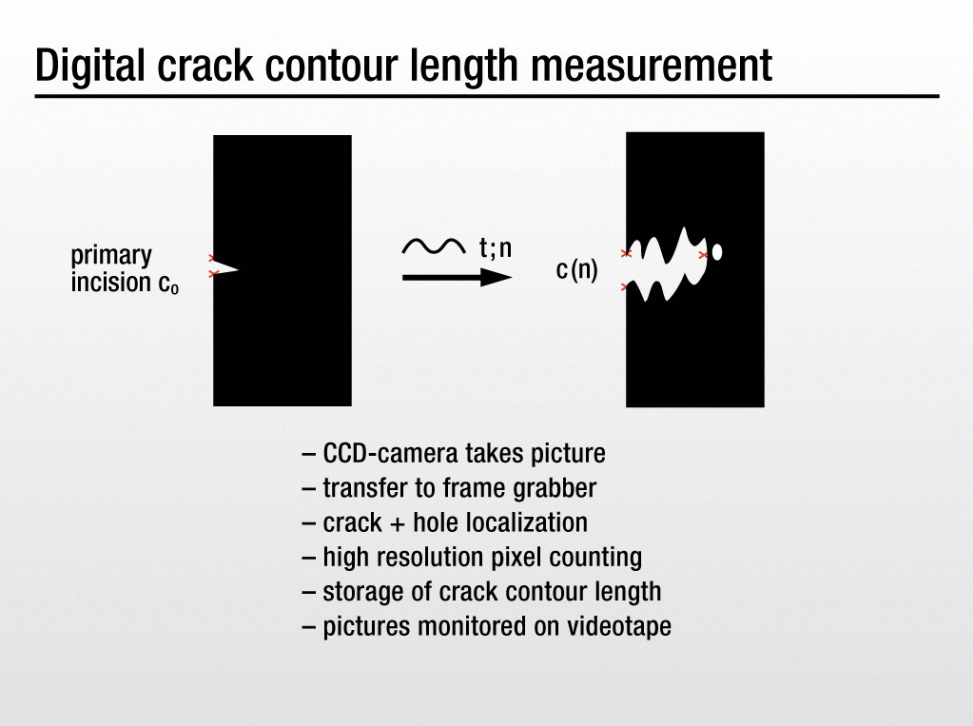
The Tear Analyser measures the crack propagation rate quantitatively and correlates it with the mechanical parameters during straining. A pulser dynamically powers a piston with sample clamp attachments. The pulser itself is driven by a frequency sweep generator through sine-shaped or any other waveform (e.g. half sine load cycles followed by an arbitrary relaxation time). The samples are subjected to the load in a temperature-controlled chamber. The waveform of the frequency generator determines the time dependence of the strain for each cycle, whereas the time dependent stress is measured by fast load gauges.

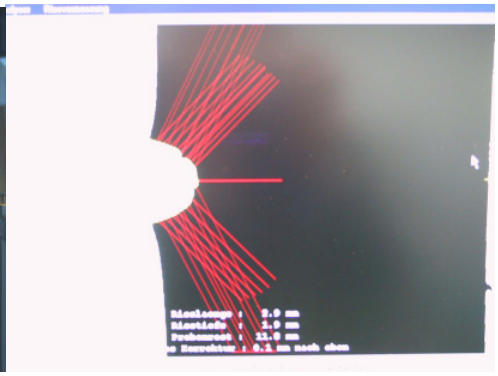


The system contains up to 10 measuring stations with a separate load cell. Each load cell and its corresponding sample clamp attachment are connected to a computer-controlled motor to maintain a constant minimum pre-stress, i.e. to ensure constant strain during the whole time of the experiment. This continuous control of constant strain is extremely important for investigations of rubber samples with high tension set. [1]

Camera System

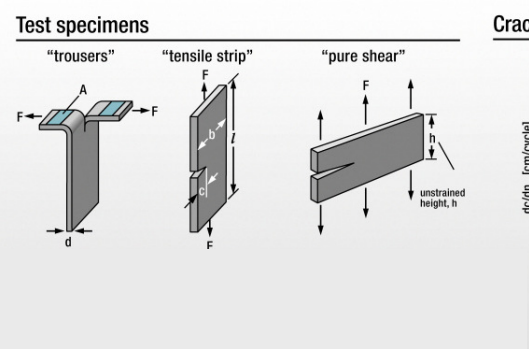
A CCD-video camera system is mounted onto a motor driven sled to determine the crack contour length. The camera moves along the axis from sample to sample each of which is mounted in front of a light screen. The crack is centred by movement of the camera. The picture is transferred to a frame grabber and stored. After the picture has been digitized the software localizes the crack position and determines the contour length. The procedure is not dependent on how the crack propagates through the sample. [1]

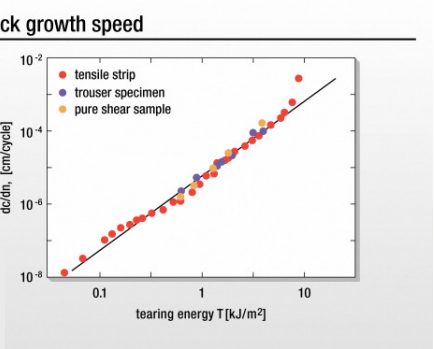




Specimen

Technically trousers, tensile strip and pure shear specimen yield the same crack growth results. The Tear Analyser can observe crack growth for tensile strip and for pure shear specimen. The fully equipped standard system holds 10 tensile strip specimens. Alternatively the system can be equipped with 10 mini pure shear or 3 full size pure shear specimen. For pure shear specimen the system allows two crack growth observations on the left and right side of the specimen.





Data Acquisition and Analysis

The Tear Analyser measures, …

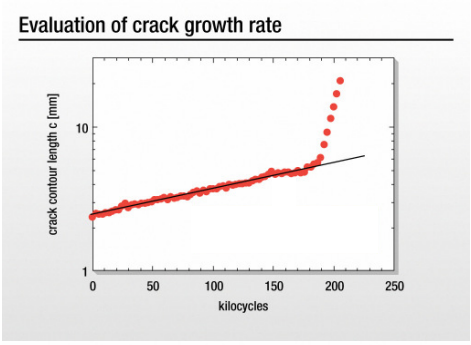
- cycle count (n)
- crack contour length
- force and stress maximum
- video of crack development

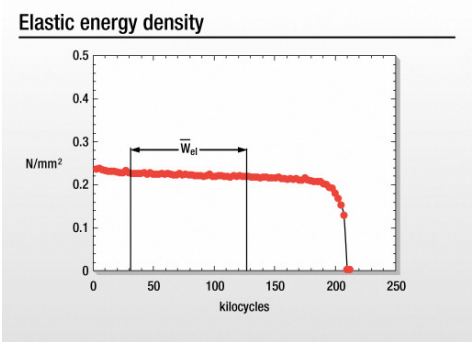
controls …

- strain
- force and stress minimum
- oven temperature

and calculates …

- total energy density
- elastic energy density
- dissipated energy density
- crack length
- crack growth rate

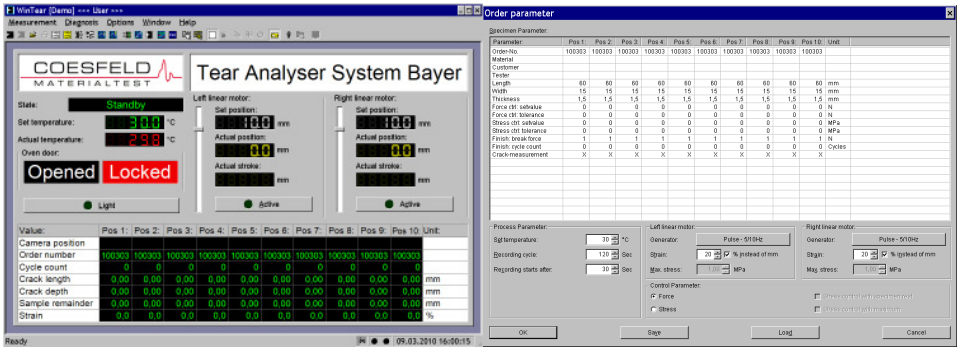




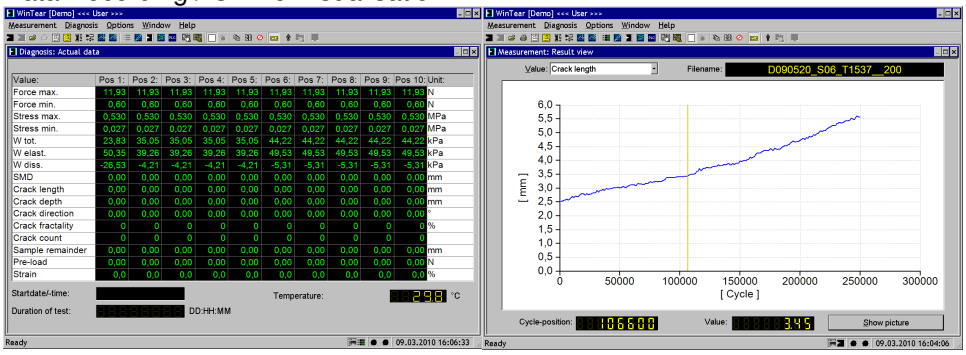
Software

The comfortable software provides a user friendly machine operation. Current measurements can be displayed, data analysis can be conducted, all data are stored and can also be exported for user defined external analysis.

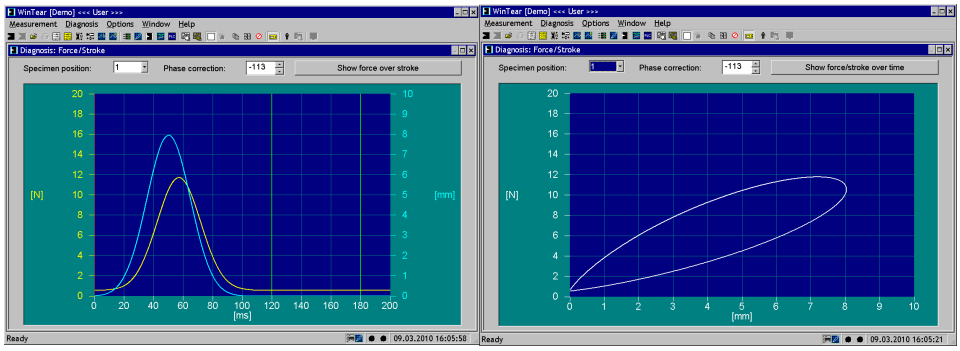
User-Panel / Parameterisation



Data Recording / Online Visualisation



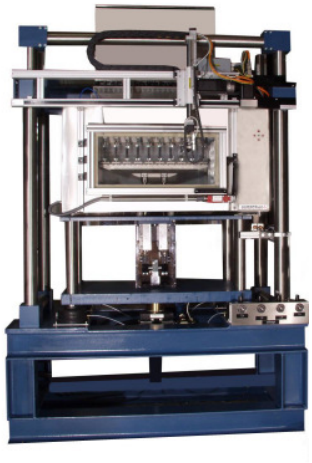
Real-Time Data Visualisation



System Configurations

Hydraulic Drive

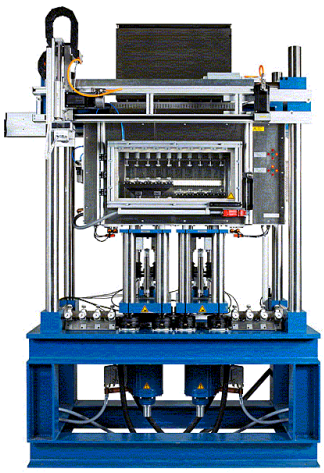
1 drive for 10 tensile strip / mini pure shear or 3 pure shear specimen



Signals:	Pulse, Triangle, Saw tooth, Rectangle, Arbitrary
Stain Amplitude:	50 mm
Frequencies:	0.1 to 50 Hz
Pre-Load accuracy	1 N
Temperature:	-20°C to +150°C
Ambient conditions:	air, O3, N2

Two Electrical Drives

2 electrical drives each for 5 tensile strip / mini pure shear or 1 pure shear specimen



Signals:	Pulse, Triangle, Saw tooth, Rectangle, Arbitrary
Stain Amplitude:	50 mm
Frequencies:	0.1 to 50 Hz
Pre-Load accuracy	1 N
Temperature:	-20°C to +150°C
Ambient conditions:	air, O3, N2

Other configurations and 1 station system refitting are possible

Conclusion

The Tear Analyser represents an instrument, which allows the quantitative reproducible determination of differential crack propagation mechanisms under specific degradation parameters. [1] The possibility of testing up to 10 specimens at a time allows recording a sufficient data base for statistical evaluation in a time efficient manner. More than 20 years of experience and development guarantee a reliable system.

Literature

[1] Eisele, U., Kelbch, S., Engels, H-W., The Tear Analyzer – A new tool for quantitative Mesurements of the dynamic Crack Growth of Elastomers, Kautschuk+Gummi, Kunstoffe 45. Jahrgang, Nr. 12/92

[2] Sumner, A.J.M., Kelbch, S.A., Eisele, U.G., Crack growth performance of tire compounds, Rubber World, Nov. 1995