EKTRON TEK CO., LTD.

Leading Manufacturing In Testing Industry

EKT-2003S Moving Die Rheometer
EKT-2003SP Moving Die (Foam Pressure) Rheometer

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EKT-2003S/2003SP series of MOVING DIE RHEOMETER are high precision instruments that offer excellent sensitivity and reliability of measurement for the evaluation of vulcanization properties of rubber compounds.

The instrument is designed in accordance with ASTM D5289 & ISO 6502 standards, the rubber test piece is contained in the bioconical die capacity and maintain at stable die temperature. Through the oscillating of lower die at small rotary amplitude, a precise transducer that is installed upon the upper die will measure the reaction torque of vulcanizing rubber.

The latest technologies in temperature control and torque measurement are applied to ensure the faster temperature response, greater repeatability and reproducibility of test results. Besides the scorch time and cure time, both of the viscous and elastic properties of vulcanizing rubber could also be accurately measured and analyzed.
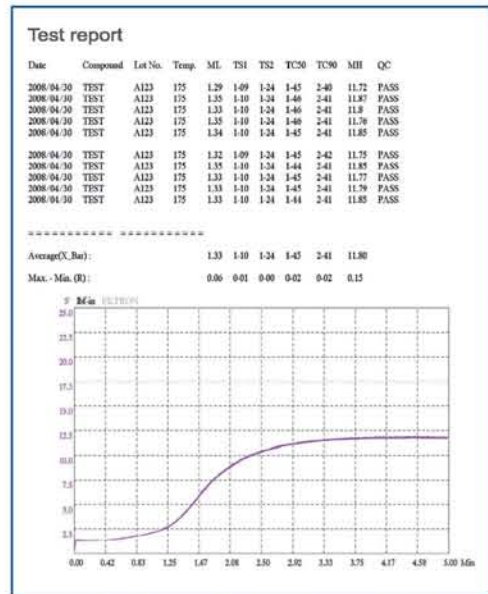

Special Functions and Features

Improved Die Structure & Torque Measurement System Provides Better Sensitivity

- The new designed die structure provides simple and easy test piece loading and removing also ensures the vulcanization properties of rubber compounds presented perfectly due to the fact that test specimens in the die cavity are held firmly.

- The new improved rotorless moving die cavity system ensures the stable die cavity pressure during the test and provides true viscoelastic property of rubber compound in vulcanization stage.

- The torque-measuring device installed upon the upper die eliminates extra resistance forces generated from the oscillating structures.

Greater Repeatability

Through over 25 years of experiences in continuously dedicated in research and development of improving Rheometer, the new introduced EKT-2000S Moving Die Rheometer provides high sensitivity and greater test repeatability.

Test report

Date	Compound	Lot No.	Temp.	ML	TS1	TS2	TC50	TC90	MH	QC
2008/04/30	TEST	A123	175	1.29	1-09	1-24	1-45	2-40	11.72	PASS
2008/04/30	TEST	A123	175	1.35	1-10	1-24	1-46	2-41	11.87	PASS
2008/04/30	TEST	A123	175	1.33	1-10	1-24	1-46	2-41	11.9	PASS
2008/04/30	TEST	A123	175	1.35	1-10	1-24	1-46	2-41	11.76	PASS
2008/04/30	TEST	A123	175	1.34	1-10	1-24	1-45	2-41	11.85	PASS
2008/04/30	TEST	A123	175	1.32	1-09	1-24	1-45	2-42	11.75	PASS
2008/04/30	TEST	A123	175	1.35	1-10	1-24	1-44	2-41	11.85	PASS
2008/04/30	TEST	A123	175	1.33	1-10	1-24	1-45	2-41	11.77	PASS
2008/04/30	TEST	A123	175	1.33	1-10	1-24	1-45	2-41	11.79	PASS
2008/04/30	TEST	A123	175	1.33	1-10	1-24	1-44	2-41	11.85	PASS

Average(X_Bar) : 1.33 1-10 1-24 1-45 2-41 11.80

Max.-Min.(R) : 0.06 0-01 0-00 0-02 0-02 0.15

Stable Temperature Control

Rapid thermal recovery
The direct heating dies and microprocessor control system minimize the time of heating and the die temperature recovery during the test.

Increase test capacity
Rapid die temperature recovery and small volume sample size reduce the curing time and increase the amount of test pieces.
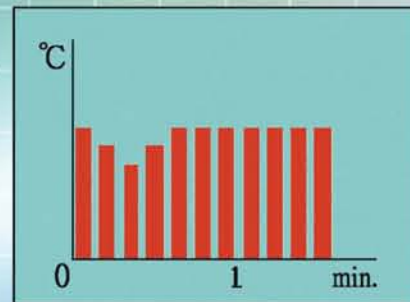
Friendly & Simplified Operation

Windows® operation system
Windows® system software offers easy learning and friendly operation environments. From the software help manual, the user can easily and quickly review the operation steps.

Easy specimen removal
The new designed die cavity uses HDPE Polyester film to separate the test sample and dies from directly contact to eliminate the die contamination also enable the user to remove the tested sample more easily.

Automatic Data Processing

The computerized system and auxiliary professional processing software will automatically save all the test results including data and curves. The professional operation software provides comprehensive functions such as quality check, (SPC) statistical...etc.
Windows® is a registered trademark of Microsoft Corporation.

Easy Torque Calibration

The instrument also provides torque calibrator. By using the auxiliary of calibration software, the user can easily run the torque calibration periodically.

ILLUSTRATIONS

M_i	:	Initial torque
M_L	:	Minimum
M_{HR}	:	Max. torque of reverting curve
M_H	:	Max. torque
M_{HFP}	:	Max. torque where curve plateaus

M_{HFP}	:	Final torque of reverting curve
T_{S2}	:	Scorch time
T_{C90}	:	Cure time to 90% of torque increase
M_{S2}	:	Torque to the scorch time
M_{C90}	:	90% of torque increase

Cure curves types

As shown in the following picture, according to the differences of rubber compounds, the cure curves are classified typically in three types:
1. Vulcanization to equilibrium torque.
2. Vulcanization to a maximum torque with reversion.
3. Vulcanization with continuously increasing torque.
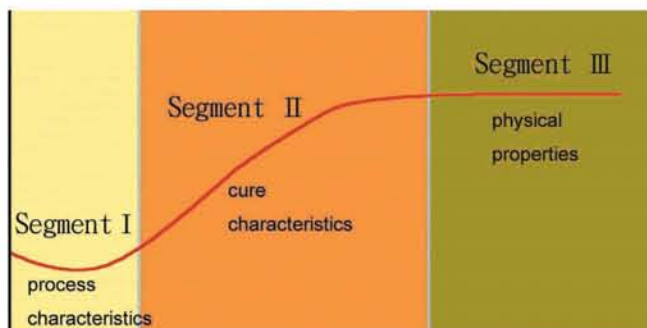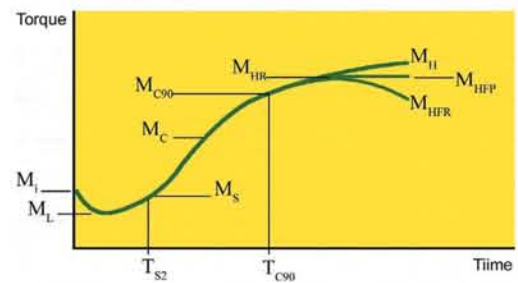

Curve Segments

Typically, the cure curve as shown below can be divided into three segments. For segment I, it gives the information related to the processing characteristics such as the viscosity and the fluidity. For segment II, it shows the characteristics of curing rate. And for segment III, it indicates the physical properties such as stiffness, hardness, strength...etc.
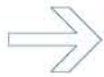
Testing Curves

After each test, as shown below, there are totally of 7 (9 for EKT-2000SP) types of curves can be measured. The user can select one or more to show on the monitor or print them out.
1. Elastic torque curve
2. Viscous torque curve
3. Viscous-elastic complex curve
4. Loss angle curve
5. Cure rate curve
6. Upper/Lower dies temp. curve
7. Tan δ curve
8. Foam pressure curve (for EKT-2000SP model)
9. Pressure rate curve (for EKT-2000SP model)
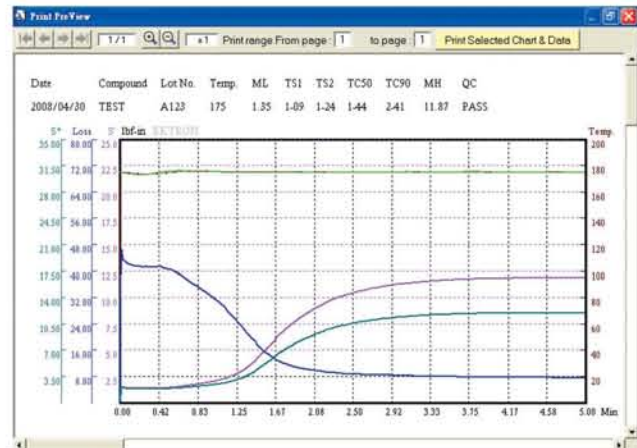
ILLUSTRATIONS

TS: Scorch times	Min. Tan δ :Minimum Viscous / Elastic ratio
TC: Curing times	Max. Tan δ :Maximum Viscous / Elastic ratio
MS: Torque related to scorch times	PC2%: [(Max. P–Min. P) x 2% + Min. P]
MC: Torque related to curing times	PC95%: [(Max. P–Min. P) x 95% + Min. P]
ML: Minimum Elastic torque	T@PC2%: Time at Pressure 2%
MH: Maximum Elastic torque	T@PC95%: Time at Pressure 95%
Min. P: Minimum Foam Pressure	MPR: Maximum Pressure rate
Max. P: Maximum Foam Pressure	T@MPR: Time at MPR
Min. S" : Minimum Viscous torque	CRI: Cure rate index
Max. S" : Maximum Viscous torque	

More Test Results

Advanced structure and measurement provide more test results. And the flexibly designed software also provides more possibility of data increment.
1. Elastic torque, such as ML, MH, MS1, MS2, MS50, MC90…etc.
2. Scorch and Cure time, such as TS1, TS2, TC50, TC90, TC95…etc.
3. Cure rate, such as CRI (cure rate index), MCR (maximum cure rate)…etc.
4. Max. & Min. Values of each curve, such as Tan δ max, δ max, S" max…etc.
5. Times related to specified points, such as T@ Tan δ max, T@MCR…etc.

Functions with different Models

| MODEL	EKT-2003SP	EKT-2003S
ELASTIC TORQUE CURE	V	V
VISCOUS TORQUE CURVE	V	V
VISCOUS-ELASTIC COMPLEX TORQUE	V	V
LOSS ANGLE CURVE	V	V
CURE RATE CURVE	V	V
UPPER/LOWER DIES TEMP. CURVE	V	V
TAN δ CURVE	V	V
FOAM PRESSURE CURVE	V	
PRESSURE RATE CURVE	V	

Software Features

1. Friendly Windows operation system offers easy and friendly operation interface.
2. Automatic Data Processing - Data collection, processing and storage are carried out automatically by professional software.
3. Test results and curves can be saved and retrieved for review or analysis.
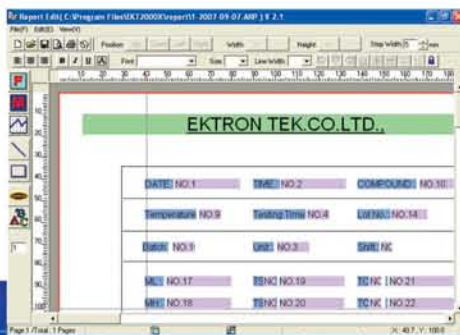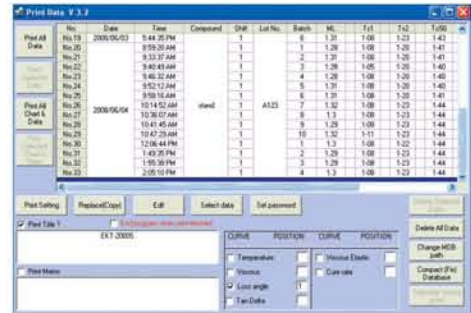
4. Easy for users to design an ideal test report that displays numbers, sketches or both in the same report.

5. EKTRON software provides help manual for users to check the software operational details easily.
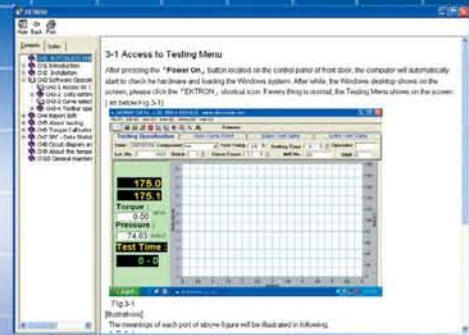
Statistical analysis

The (SPC) Statistical Process Control software provides user to analyze the test results related to elastic torque curve such as the Minimum torque (ML), Scorch times, Cure times and Maximum torque more easily.

This SPC software is also available for drawing charts including the X-MR, X-R, Histogram and Normal distribution. The software can figure out selected data related to process control such as Cp, Cpk, Mean, Standard deviation, and 6 sigma.
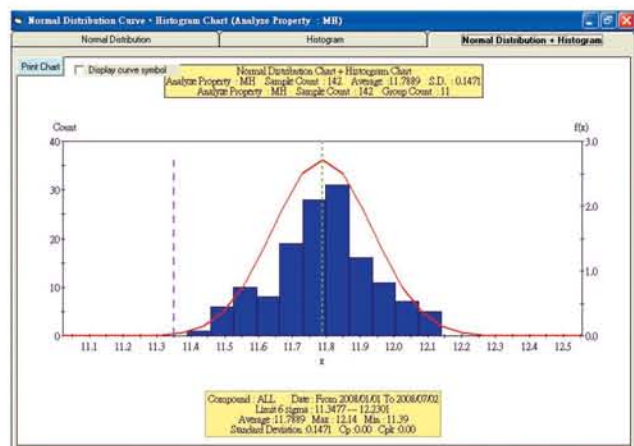
Data export and Data Network System

Data Export

After test, the test data can transfer into text or PDF or export to Excel for future analysis.

Data Network System

Data Network System provides data connection capability for user to connect EKTRON Rheometer, Moony Viscometer, and Tensile Tester together and collect all test data in one host computer. If necessary, the built-in network interface can easily provide the user to link the instrument to the internal network.
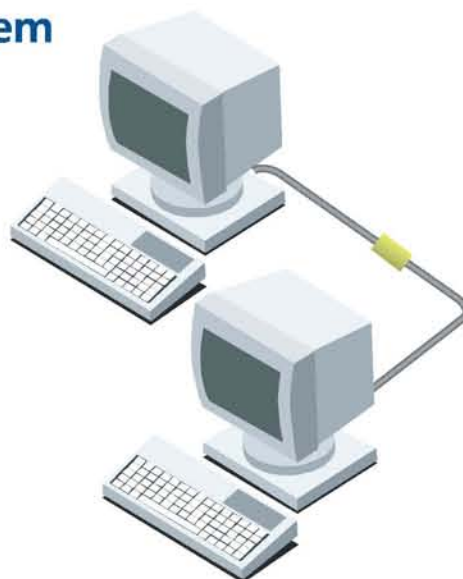
Optional Accessories

Volumetric cutter for Sample Preparation

EKTRON provides optional choice of EKT-2001EKVC sample preparation cutter.

Specifications

01. Testing Standards	ASTM D5289, ISO6502
02. Oscillating frequency	100 cycles/min. (1.66Hz)
03. Oscillating amplitude	±0.5°, ±1.0°, ±3.0°
04. Temperature	Range 30°C~ 200°C (High temperatures are available on customer's order.)
05. Measurement Units	Torque: kgf-m, lbf-in, dN-m Temperature°C
06. Sample volume	≒4.5cm³
07. Air pressure	4.5 ~ 5.0 kg/cm²
08. Electrical	220±10% VAC, 50/60±3Hz, 7 Amp single phases.
09. Accessory	Torque standard
10. Weights (Approximately)	Main machinery: 300kg
11. Dimensions (Approximately)	Main machinery: 620(L)x820(W)x1320(H) mm

* All specifications, dimensions and design characteristics are subject to change without notice.

Main product :

- RHEOMETER
  - Dynamic Processing Rheometer
  - Moving Die (Foam Pressure) Rheometer
  - Moving Die Rheometer
  - Oscillating Disc Rheometer
- Tensile Tester
- Mooney Viscometer
- Plunger Tester
- Mixing Grader
- Vibration Simulator
- Flexometer
- Automatic Ozone Test Chamber
- Fatigue Failure Tester
- Demattia Flexing Fatigue Tester
- Low Temperature Retraction Tester
- Gas Permeability Tester

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