Elastic Modulus and Internal Friction Meter

Nihon Techno-Plus Corp. (=NTP Nihon=Nippon)

Our major products are measuring equipment of Elastic Modulus, Elastic Stiffness (Elastic Constant) and Internal Friction. These can measure Young's modulus(E) , Shear modulus(G), Poisson's ratio(ν) Internal friction(Q^{-1}) and Elastic Stiffness Cij in wide range of sample form and temperature.

NTP is not only a maker, but also a laboratory of state-of-the art measurement methods for physical properties of materials. We have been researching sensing technologies accompany with the universities and laboratories. NTP has developed many kinds of instrument and we understand the characteristics of each measuring method. Beginners use the instrument as a black box. In physical measurement, the measured value is not always correct due to the measurement principle. We know the characteristics of each device, including products of other companies, and recommend the device and measurement method according to the research.

Now, NTP is growing up to the "Total Measurement System Solution Provider" of Elastic Modulus and Internal Friction.

"Series" in this description means having the following types :
"-RT" : room temperature "-HT": high temperature, "-LT" low temperature "LHT": from Low temperature to high
These specifications are limited to standard sample.

EG-series

The device can measure multiple items with most easily operation and high reliability at high temperature. (patented)

EG-HT can measure max1200 degrees Celsius with its own small electric furnace, and measuring mechanism uses unique cantilever method.

Own small furnace gives you energy saving and unique cantilever method has the many merits. This measuring unit can measure many types of items, E, G, and Q^{-1} by bending and twisting using this unit, then Poisson's ratio is calculated by E and G.

Next advantage of EG-series is easy operation for measurement even hard vibration states of material. These states appear high dumping materials as solder, resin, brick and so on.

Hard vibration materials have many counterfeit resonance. Operator may mistake to get the counterfeit vibration peak.

And then this states appear from materials that in high temperature range because this phenomenon also arises from materials that change at high temperatures.

EG-series can erase these counterfeit vibration and only gives fundamental vibration. Then you can easily get accurate data in high temperature range by using EG-HT.

Next merit is to measure the correct physical property value. This unique cantilever method realizes low frequency measurement of several tens of Hz, and there is no measurement error due to viscosity that occurs at high temperature.

In this way, EG-HT is a valuable device that can simultaneously measure many measurement items and solve many problems at high temperatures.

Principle	:	Resonant Method with Cantilever Bending & torsion mechanism
Items	:	E, G, Poisson's ratio and Q^{-1} with bending and torsion
Temperature	:	RT~1400K (Developing up to 1600K)
Frequency	:	8Hz ~ 400Hz (Extensible)
Materials	:	Metal, Ceramics, Polymer, resin, Glass, brick & others
Specimen	:	Plate 1~2.5mmT, 2~10mmW and 50~60mmL Above is standard. Limit is depend on sample materials
Meas. Condition	:	Temperature, Strain and Time depending
Feature	:	Easy operation in hard vibration states of material
Types	:	EG-HT, EG-LHT

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JE-series The most accurate and versatile Young's modulus and internal friction measuring device

JE-series uses the free resonance method, and since both mechanism of the driving and the detection of vibration are non-contact methods, there is no human operation error and the accuracy is extremely high. Since the sample is placed on the suspension line at the position of the vibration node, it can be measured accurately without affecting the frequency of the sample. Then, beginners can measure with high accuracy by our original measurement method.

Frequency range of standard spec. is 500Hz~20kHz, and this range is practicable to measure wide range specimen. We provide a custom-made JEH type that measures at 20kHz or higher for measuring short samples and high-rigidity samples.

JE-RT gives you higher precision, higher repeatability, easier sample setting and wider range of sample form and dimensions. You can measure plate, wire, rod, cylindrical bar and others by using this device. Non-contact vibration and non-contact detection can measure 0.1 mm thick samples in some cases such as metals and ceramics.Sample setting is very easy by JE-RT but in case of JE-HT or JE-LHT, sample size is limited by reason of temperature distribution.

Principle	:	Resonant method using Free Vibration mechanism
Items	:	E and Q^{-1} with bending
Temperature	:	100K~RT~1270K
Frequency	:	600Hz~20,000Hz (Acoustic Sensor) or 600~3000Hz (Distance Sensor) Peak Adjustable by 0.001~0.01Hz step
Materials	:	Metal, Ceramics, Polymer, resin, Glass, brick & others
Specimen (JE-RT)	:	plate 0.8~5mmT, 1~15mmW and 35~140mmL Wire 0.8~15mmD and 35~140mmL (max 60mmL for -LT & -HT) Above is standard. Limit is depend on sample materials and frequency Range.
(option)		Available for Pipe, Triangle bar and other bar with uniform section
Features	:	highest precision and repeatability and easy sample setting Wide range of sample form and dimensions Attention about measurement in high temperature range
Types	:	JE-RT, JE-HT, JE-LT, JE-LHT

JG-series Shear modulus and internal friction using free vibration method (patented)

The advantages and features of JG-series are same as JE-series except sample dimensions. It can measure plate only. Minimum width is 5mm. It is the narrowest in case of using free vibration system. Other specifications are based on them of JE-series.

In general, JG-series is used as attachment of JE-series and other our devices. And it is used for G-calibration and/or calculation of Poison's Ratio.

TE-series Young's modulus and internal friction for thin plate and thin wire using cantilever type

This device was designed for measuring Young's modulus and internal friction of thin plate and thin wire. In case of the free vibration method, thin plate and thin wire has many complex vibrations. Then it is difficult to determine the 1st fundamental vibration mode. This device uses cantilever type for node fixture, then you can easily get 1st fundamental vibration.

According to our experiments, we can measure the size of down to 0.03mm diameter Au-wire and 0.03mm thickness ribbon of metal.

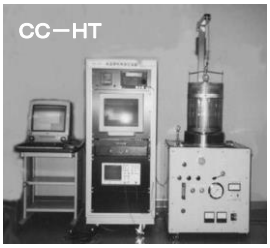
Our development of the high temperature driver and detector for vibration makes to be able to measure in wide temperature range.

Principle	:	Resonant Method with Cantilever Bending mechanism
Items	:	E, and Q^{-1}
Temperature	:	100K~RT~1000K
Frequency	:	8Hz ~ 400Hz (Extensible)
Specimen	:	Ribbon 0.03~0.8mmT, 2~10mmW and 30~50mmL Wire 0.03~0.8mmD and 30~50mmL Above is standard metal. Limit depends on sample materials.
Materials	:	Metal, Metallic glass, High polymer, Resin and so on
Meas. Condition	:	Temperature, Strain and Time depending
Types	:	TE-RT, TE-HT, TE-LT, TE-LHT

CC-series — Elastic moduli & Cij for single crystal using piezoelectric cube resonant method

The elastic modulus is a macro value of the elastic constant between atoms. Normally, the material is calculated as an isotropic, but in case of anisotropy like a single crystal, it is necessary to calculate the elastic modulus by measuring the elastic constants. This device measures the resonance frequency in eight vibration modes from sample to obtain elastic constants. It is also usually called the RUS method.

Principle	:	Cubic Resonant Method using PZT driving and detection
Items	:	E , G, ν and Cij (stiffness)
Temperature	:	RT~1000K (Max 100K~1200K)
Frequency	:	100KHz ~ 2.5MHz
Specimen	:	Rectangular with about 5mm of 3 dimensions Sample edge direction and crystal mirror direction are fit in 1 degree.
Materials	:	Single Crystal
Meas. Condition	:	Temperature depending
Types	:	CC-RT, CC-HT, CC-LT, CC-LHT



CC Ⅱ series — Easy analysis of Elastic constant by specifying vibration mode

CC2 is a device that more easily measures complex elastic constants using the EMAR method, which can vibrate in a specific vibration mode. EMAR is “Electro Magnetic Acoustic Resonance”. If the material called isotropic contains a slight anisotropy, elastic moduli are more accurate to measure and calculate the elastic constant. CC2 is a device to measure the mechanical characteristics of the near future.

Principle	:	EMAR (Electro Magnetic Acoustic Resonance) Method
Items	:	E , G, ν and Cij (stiffness)
Temperature	:	RT~1500K
Frequency	:	300KHz ~ 2.5MHz
Specimen	:	Rectangular and cylinder with about 5mm of 3 dimensions
Materials	:	Single Crystal and Poly crystal
Meas. Condition	:	Temperature depending
Feature	:	Cij of single crystal and Poly crystal
Types	:	CC2-RT, CC2-HT,

VE-RT — Young’s Modulus(E) using vertical vibration method

Ⅰ E-RT — Young’s Modulus(E) using Impact vibration method

These measuring methods are old type. But they are useful to measure in specific sample form and large size. They are too useful to measure on the spot. We provide these devices for these customers’ requirements.

Principle	:	Resonant Method
Items	:	E
Temperature	:	RT (Available high or low temperature)
Frequency	:	Available to material property
Specimen	:	Carbon Wood Concrete Brick Above is standard metal. Limit depends on sample materials.

MS-series Mechanical Spectrometer by Internal Friction with forced vibration method

The measurement principle is “Forced Vibration method”, that can provide reliable data, because this measures internal friction by changing frequency at fixed temperature. Resonant vibration method is widely used for internal friction measurement, and it measures to get the data of the temperature distribution of internal friction by changing temperature. But the temperature changing method may cause material properties may be not constant.
Researchers want to get the distribution of internal friction at the fixed temperature. The device what they want is MS-series. The researcher can analyze and calculate mechanism of material characteristics.

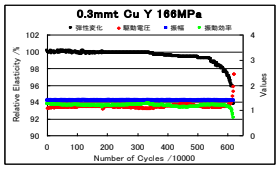
Principle	:	Torsion by Force Vibration method using cantilever pendulum mechanism
Items	:	Internal Friction (Q^{-1})
Frequency	:	1mHz ~ 10Hz (Max 0.1mHz~10Hz)
Temperature	:	RT ~ 800K (Max 100K~1100K)
Meas. Condition	:	Frequency and Temperature depending
Materials	:	Metal, Ceramics, Polymer, resin, Glass, brick & others
Specimen	:	Plate 0.2~1.5mmT, 1~5mmW, 30~60mmL
		Bar 0.2~1.5mmD, 30~60mmL
Resolution	:	0.0001 of Q-1
Output data	:	Raw Data Data processing is selected by user.
Types	:	MS-RT, MS-HT, MS-LT, MS-LHT


MS-HT

RF-series Fatigue Tester for Thin plate

RF-series is developed as the fatigue tester based on university research. Driving is resonant method which is professional technology of NTP. This device has many excellent features compared with traditional fatigue testers by using free resonant method as follows.

Process observation: monitoring resonant frequency change with increasing damage of test piece
High Speed testing: The 10^7-cycles test finishes in about 7 hours in case of 400Hz.
Non-Heat up at the fatigue point
Low noise (Silent)
Compact
Low power 100~125V 200W
Save Cost: Low price



Test Piece: Thin plate 0.15~0.5mmT x 3mmW x 20~40mmL (in case of Cu)
Metal, ceramics, Composite material, Polymer and others
.Frequency: 150Hz~800Hz (Dependence on material property and Recommendation under 500Hz
Types: RF-RT, RF-HT(RT~478K)

Company Profile

NTP Mind is “A wealth of Heart and Excellent Technologies”

Nihon Techno-Plus Corp. (NTP), a venture company in Japan established in 1989, has been challenging new needs from customers of the frontier science and engineering with flexibility.
To realize them and to offer good products, we study at professional conferences and symposiums, and all of our members share the information, the experimental results and discuss the developments with professional advisers. The jobs in our company are same as the studies, not labor.

At the same time, we want to make society better and to be a good corporate citizenship. We are trying to get the satisfaction of the conditions of company for our members, and we are going to get the volunteer spirits and to practice its activities for society as company minds.

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