

**PROPERIS**

The **PROPERIS** HFR series is the *High Frequency Rheometer*

For Evaluation of the physical properties  
of soft materials

Highfrequency Viscoelasticity Corporation

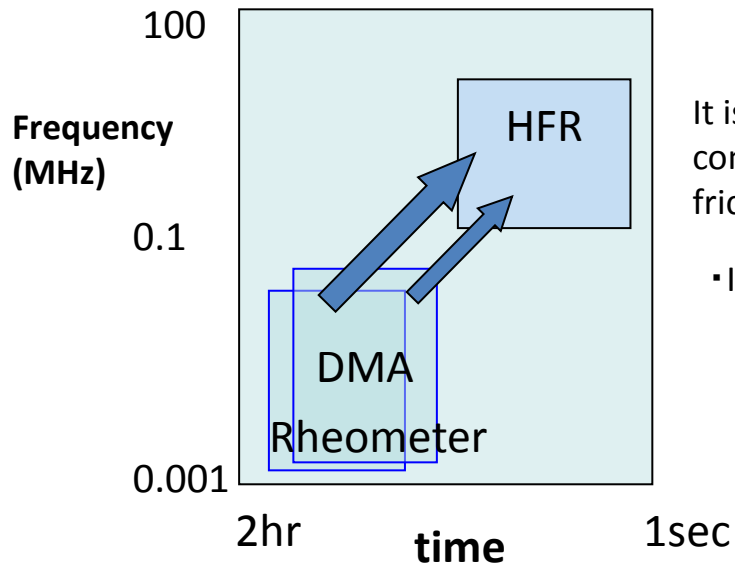
# The **PROPERIS** HFR series is the High Frequency Rheometer



# To realize the 3R that are desired in the industry

# PROPERIS

- It has specialized in the high frequency region
- It can be measured in the field environment (Unnecessary cryostat      Unnecessary temperature-time conversion) (Real condition)
- Short measurement time (Real time)
- You can measure the actual thing (Real sample)



It is directly connected to the tire friction characteristics

- Ink evaluation

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# Features of the high frequency viscoelasticity measurement apparatus HFR

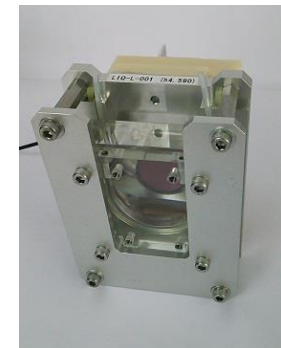
**PROPERIS**

- Unnecessary calculation of troublesome ultrasonic measurement
- Viscoelastic measurement results display a spectrum
- The numeric data in Excel output
- It can also be measured of time-varying sample by Timer measurement

## Measurement result display screen

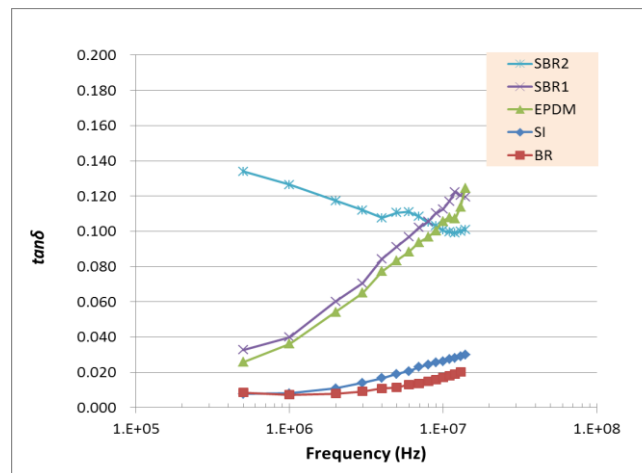
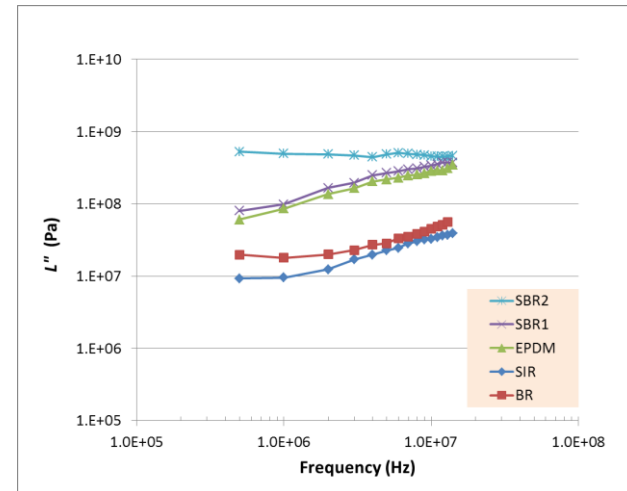
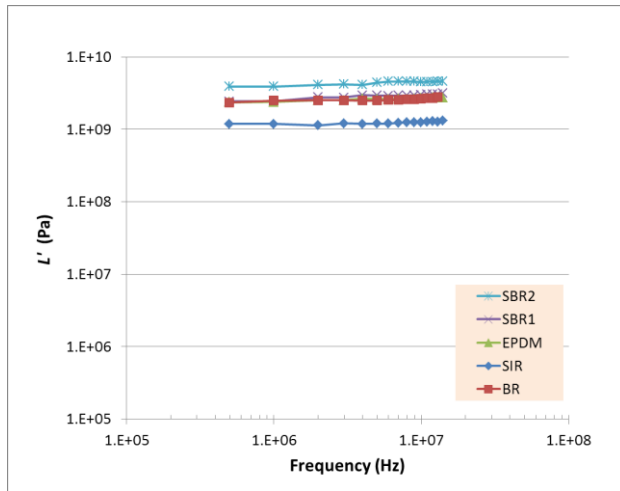


## Solid Sensor unit and sample



## Liquid Sensor unit

# Measurement example of high frequency viscoelastic properties of rubber



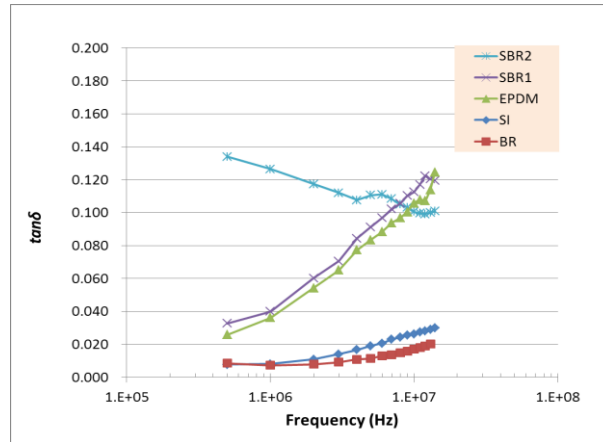
23°C

# Correlation between a functional properties

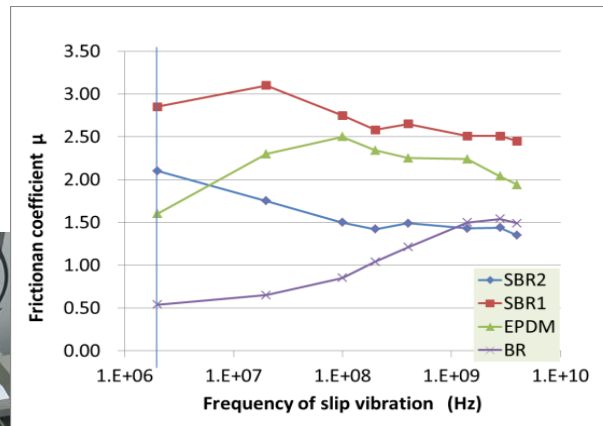
MHz band viscoelastic properties can be measured easily by using high frequency viscoelastic measurement apparatus HFR. So it became possible to study correlation between a functional properties (e.g. friction) and high frequency viscoelasticity in the actual operating temperature.



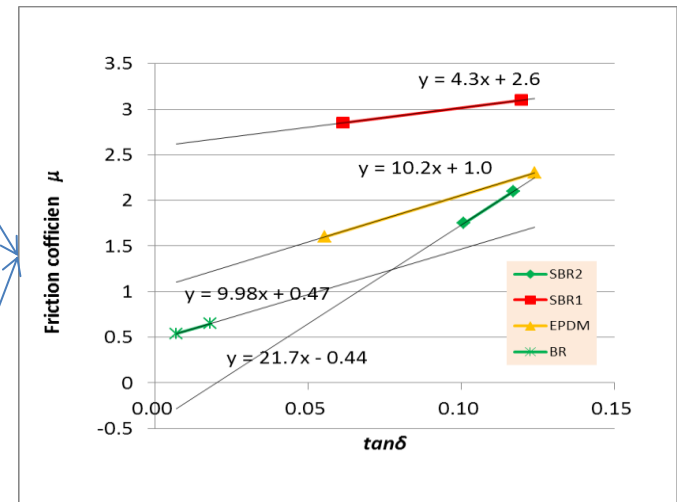
HFR



Spectrum of  $\tan\delta$ .



Spectrum of friction coefficient  $\mu$ .



Correlation between  $\tan\delta$  and friction coefficient.

$$F = F_h + F_a$$

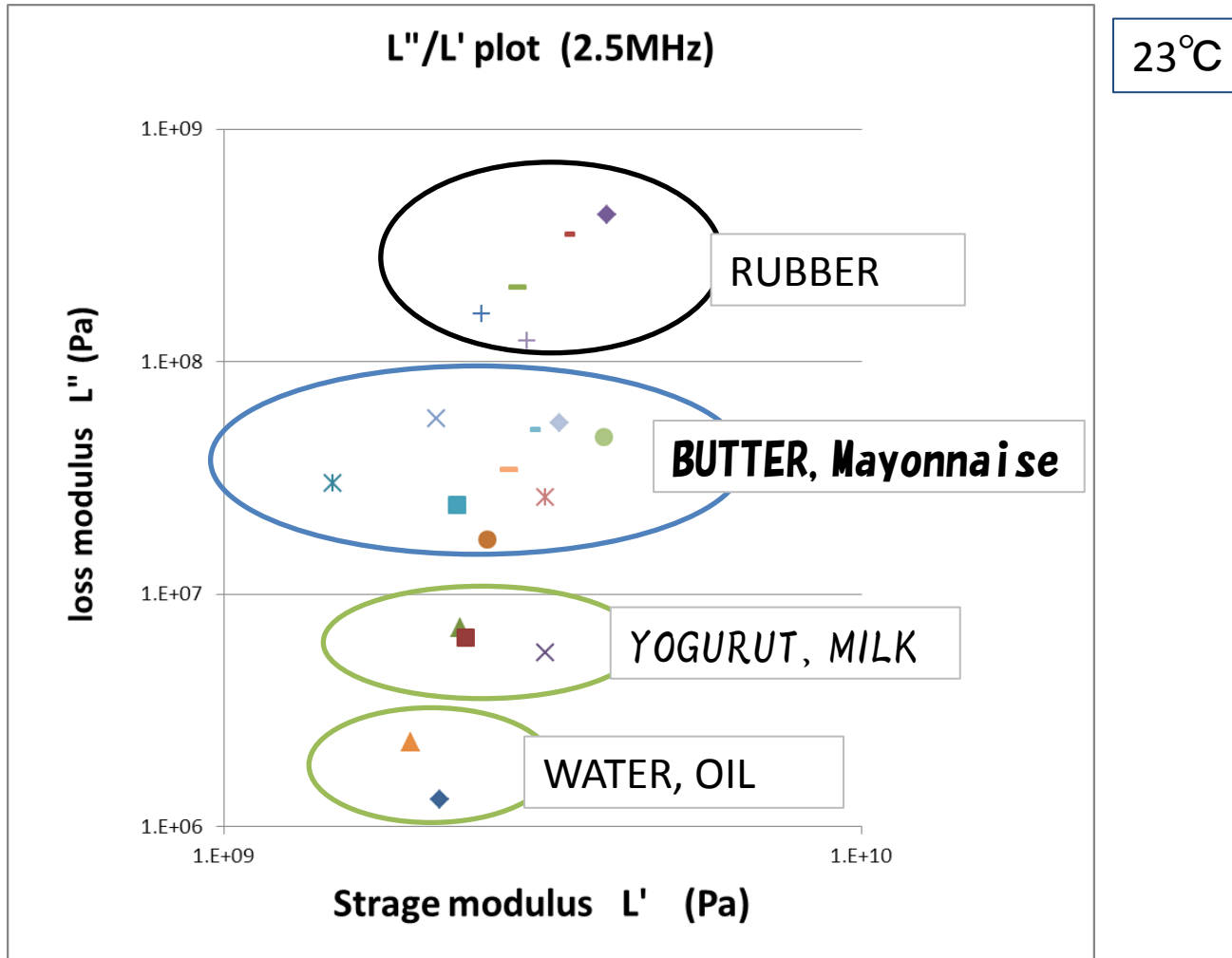
$$= K \cdot E'^{-\frac{1}{3}} \tan\delta + A \cdot s$$

By amino, iwai, uchiyama



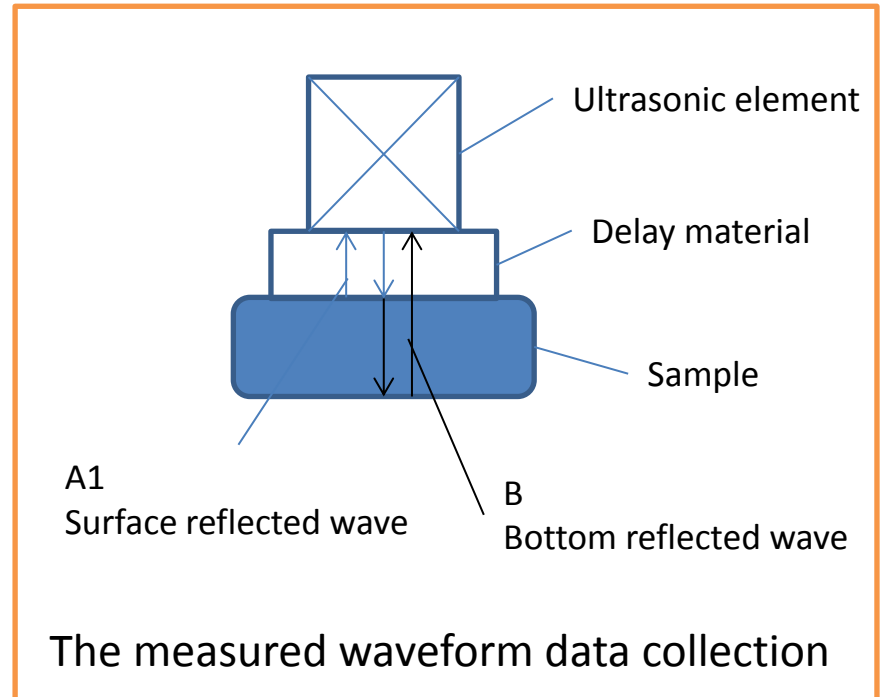
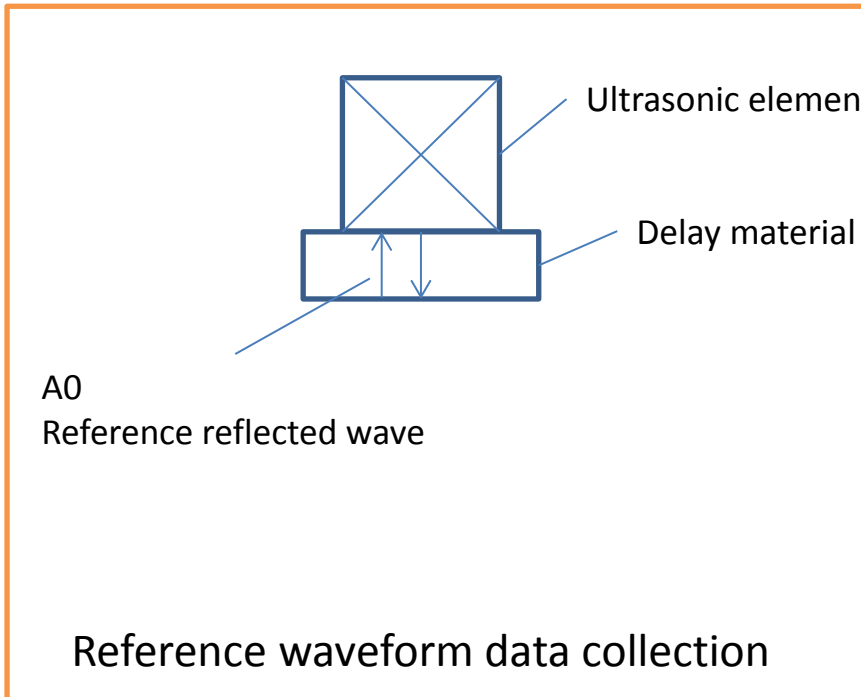
RRL

# Measurement example of the highfrequency viscoelasticity of various materials



# Waveform collection configuration

- ① You can absolute value measured by the reference waveform A0.
- ② And calculates the viscoelasticity by the surface reflected wave A1 and the bottom surface reflected wave B.  
(Bottom method)
- ③ It is also possible to calculate a viscoelastic along the surface reflected wave A1.  
(Surface method)





# Viscoelastic spectrum formula

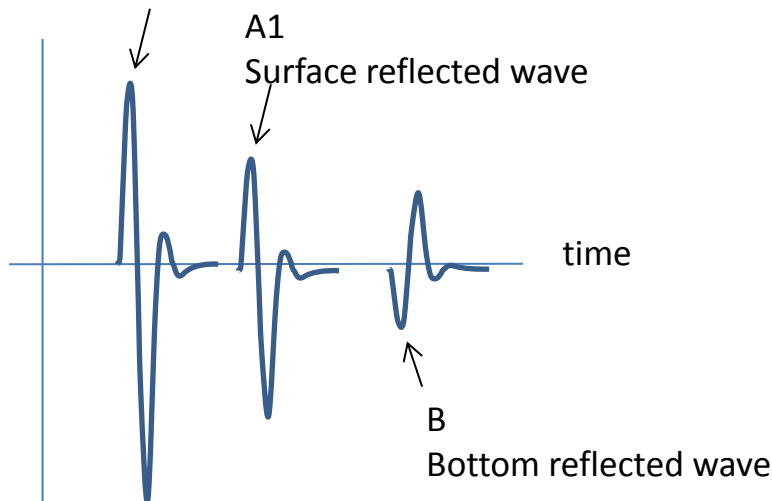
Each of the waveform FFT processing, acoustic properties (sound velocity  $V_p$ , the attenuation factor  $\alpha$ , density  $\rho$ ) by substituting the viscoelastic formula to calculate the complex modulus. (Bottom method)

$$L' = \rho V_p^2, \quad L'' = \frac{2\alpha \rho V_p^3}{\omega} = \frac{2\alpha V_p}{\omega} L'$$

$$\tan \delta = \frac{L''}{L'} = \frac{2\alpha V_p}{\omega}$$

A0

Reference reflected wave



Longitudinal waves elastic modulus	$L=K+4G/3$
Bulk modulus	$K=L-4G/3$
Young's modulus	$E=9KG/(3K+G)$
Shear modulus	$G=3KE/(9K-E)$
Poisson's ratio	$\nu=(3K-2G)/2(3K+G)$

## The **PROPERIS** HFR series is the High Frequency Rheometer

### Specification

- Measuring frequency : 0.5~20MHz
  - \* Multiple sensors is required.  
Measurement bandwidth depends on the measurement sample
- Sample: solid, suspension, liquid (there are attachment parts for each needs.)
- Sample size :
  - Plane size : 50x50mm more
  - Thickness of 1 to 10mm  
(depends on the measurement sample and measurement bandwidth)
  - \* Please consult parallelism and thickness accuracy that will be affected measurement accuracy in the solid
- Solid sensor size      WDH:300X300X500mm
- Controller size        WDH:700X900X1500mm
  - \* The high-precision measurement requires a constant temperature bath.  
(Inside dimension WDH: 600x700x900mm more)
- Weight: 135kg
- Power: 100V 1500w D species ground

\*Price and delivery time, please contact us by e-mail.

Development, manufacture and sales

### Highfrequency Viscoelasticity Corporation

224-0007

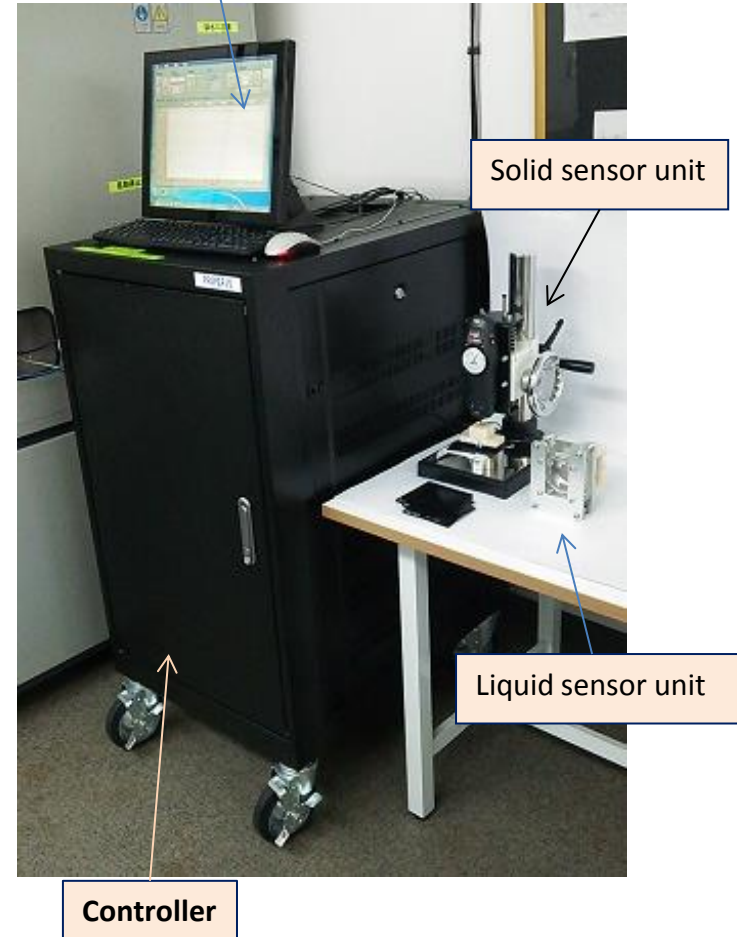
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Equipment full view

Touch panel display



Since the specifications are subject to revision without notice for improvement,  
Please contact me at the time of use is.      2015.12.02

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