

# Focusing on ease of use



## Measurement



Quick temperature adjustment, short measuring time (min. 1 sec.)

## Preparation



Fill 300 uL of the sample in the sample container

## Cleaning



No cleaning required – increased efficiency



## Electro Magnetically Spinning Viscometer

# EMS-1000S



**KEM KYOTO ELECTRONICS**  
 MANUFACTURING CO.,LTD.  
<http://www.kyoto-kem.com>

Overseas Division : 2-7-1, Ichigaya-sadohara-cho, Shinjuku-ku  
 TOKYO, 162-0842, JAPAN  
 Fax : +81-3-3268-5591 Phone : +81-3-5227-3156

Distributed by

Specifications and design subject to change for improvements without notice. Printed in Japan.

1611-23-KT

**KEM KYOTO ELECTRONICS**  
 MANUFACTURING CO.,LTD.

## New style of viscosity measurement Innovative viscometer with cutting-edge technology and user-friendly operation

EMS-1000S employs Electro Magnetically Spinning method.

A small probe sphere in the sample rotates by Lorentz force and its speed depends on the sample viscosity. EMS-1000S measures that speed and figures out the viscosity.

The intuitive and user-friendly software make it easy to operate. A variety of probe spheres are lined up for the best performance of viscosity measurement to match sample property. EMS-1000S measures small volume of sample, low viscosity sample which were difficult to measure by conventional instrument.

The application of EMS-1000S expands in a wide range of industry.

This new contact free viscometer was developed in collaboration with Institute of Industrial Science, the University of Tokyo within the framework of JST Japan Science and Technology Agency.

### Wide Temperature Range

- Temperature range:** 0 ... 200 °C
- Temperature stability:** ± 0.1 °C
- Heating rate:** within 10 minutes  
(25 → 200 °C)

A special program mode facilitates easy and fast studies of the temperature dependency of the viscosity.

Motor speed (r/min)	Measurement time (s)	Start time (s)	Temp. slope (°C/s)	End time (s)	Repeat time (s)	Interval (s)
1	2000	0	0	0	0	0
2	2000	0	0	0	0	0
3	2000	0	0	0	0	0
4	2000	0	0	0	0	0
5	2000	0	0	0	0	0
6	2000	0	0	0	0	0
7	2000	0	0	0	0	0
8	2000	0	0	0	0	0
9	2000	0	0	0	0	0
10	2000	0	0	0	0	0
11	2000	0	0	0	0	0
12	2000	0	0	0	0	0

### Prepared spherical probes for matching sample property

- Viscosity range:** 0.1 ... 100,000 mPa · s

To realize more accurate viscosity measurement, you can select a spherical probe according to the properties of the samples.

#### low viscosity

water  
solvents  
ink  
blood  
protein  
beverage

required enough

#### high viscosity

polymers | resin  
bitumen  
heavy oil

### Short Measuring Time

required

Only 1 second is required to measure samples with a viscosity below 100 mPa·s

Approx. 1 minute is enough to measure samples with a viscosity of 10,000 mPa·s



### Rheological Properties

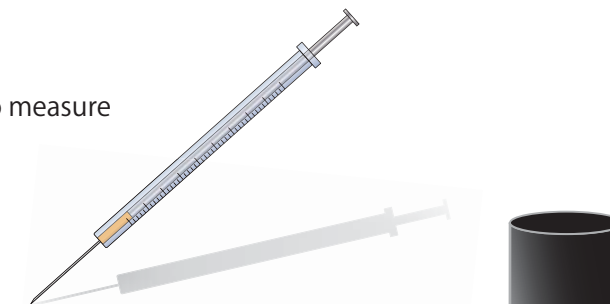
- Shear rate:** 0.01 ... 150 s<sup>-1</sup>  
(depending on the sample's viscosity)

The flow curves is created during the measurement by varying the rotation speed of motor.

### Best suited for Very Small Samples and Reuse of Precious Samples

- Sample volume required:** 300 μL  
90 μL (Option)

As small volume of sample as 300 μL/90 μL(Option) is enough to measure  
During measurement the samples are contamination-free  
Samples can be reused for other purposes after measurement.



### Versatile Measuring Container and Disposal

#### No cleaning required

Measurements are performed in a disposable sample container.  
No cleaning required – no cross contamination possible.

#### Autoclavable

Ideal for samples which must be measured in a sterile environment such as proteins.

#### Suitable for measurements under anaerobic conditions

Sealed sample container allows to perform measurements in an inert-gas atmosphere.

### Intuitive and user-friendly GUI (Graphic User Interface) Operation

The measurement result, the status of the sample, the status of the device and the graph plotting the measurement result, show up together on one screen.

It is easy to compare the measured data with the data acquired in the past by the powerful search function of the database.



### Reliable measurement by viewing the status of sample with the built-in camera

You can check the status of the sample in real time with the built-in camera in the main unit.  
In addition, more accurate measurement is possible by checking and adjusting the position and rotation status of the spherical probe.

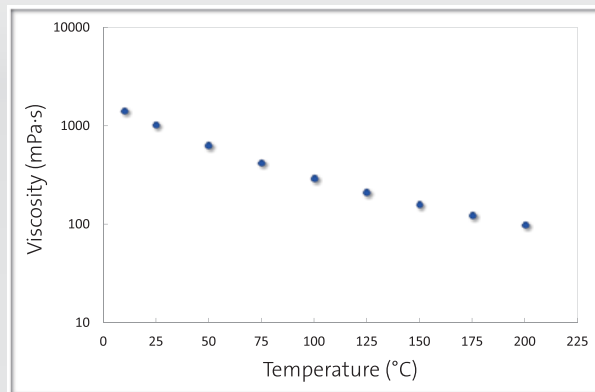


original size

## Observe what you wanted to see

### Wide temperature range from 0 to 200 °C by built-in temperature control system

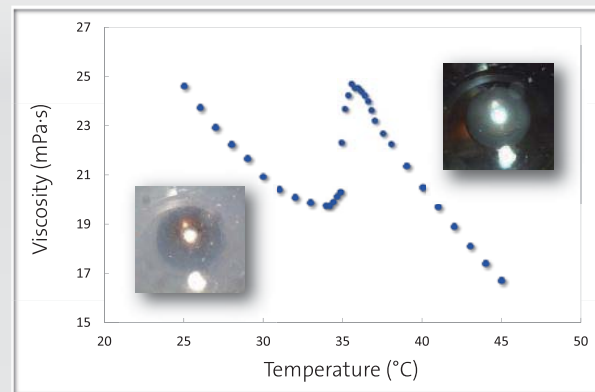
Heating up from room temperature to 200°C within 10 minutes: Studies of the temperature dependency of the viscosity have never been that quick and easy.



Viscosity vs. temperature (silicon oil)

### A CMOS camera lets you keep track of what's going on during measurement

Changes in the sample characteristics like coagulation or formation of precipitates can be studied during and after measurements, impurities in the sample can easily be detected.



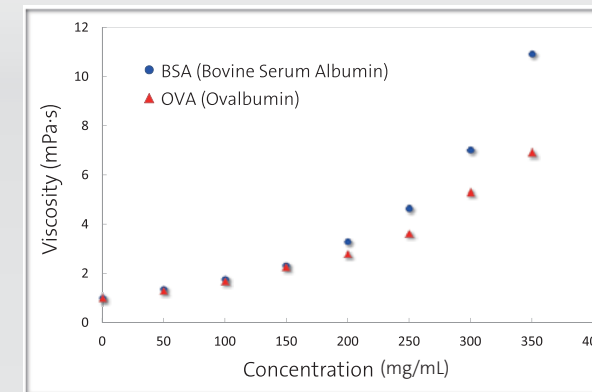
Viscosity change at phase transition temp. (liquid crystal)

## Application by industry

### Biochemistry

**Viscosity measurements of biological samples**  
available in small quantities only such as blood can be measured.

**Viscosity vs. concentration of protein solutions**  
No series of dilution is required. The same sample can simply be diluted by adding known amounts of the diluent to the sample between measurements.

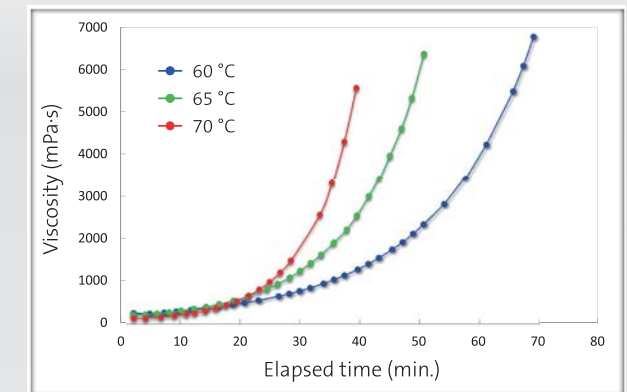


Viscosity vs. concentration (protein)

### Polymers

**Melt Viscosity of plastic**  
Solid samples can be melted directly in the measuring cell.

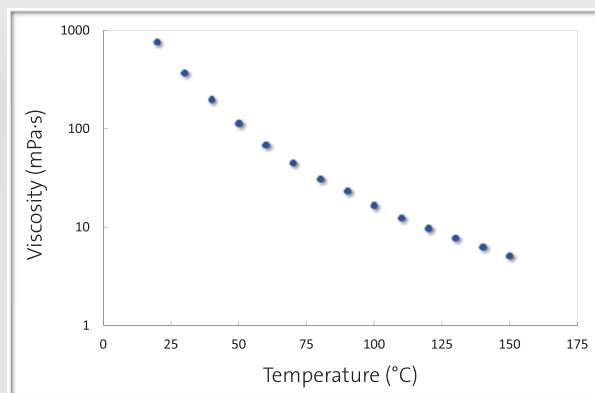
**Thermosetting resins**  
Examination of the flow properties during polymerization process. No cleaning required after measurement.



Curing process (epoxy resin)

### Suitable for air-sensitive samples thanks to sealed measuring cell

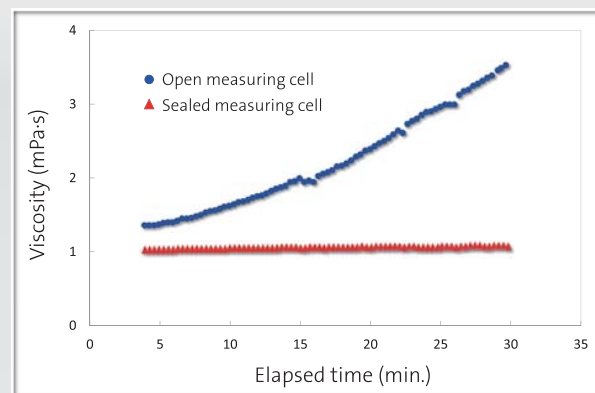
A completely sealed measuring makes sure you can measure all types of samples, regardless of whether they are toxic, highly hygroscopic, volatile or very sensitive to oxygen.



Ionic liquid, measurement performed under N<sub>2</sub>

### Highly volatile samples can be measured under overpressure

Measurements can be performed at elevated temperatures and pressures. Samples can thus be measured even well above their boiling point.

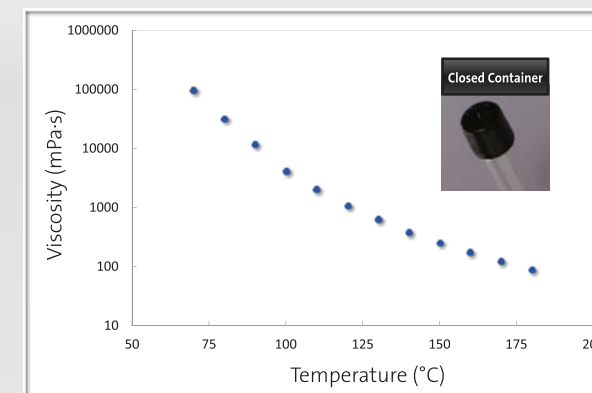


Viscosity at boiling temperature (glycerol)

### Petrochemistry

**Viscosity of heavy oil and waste oil**  
No time consuming cleaning required after measurement.

**Temperature dependency of the viscosity of asphalt**  
The sealed measuring cell protects operators from direct contact with toxic vapors.

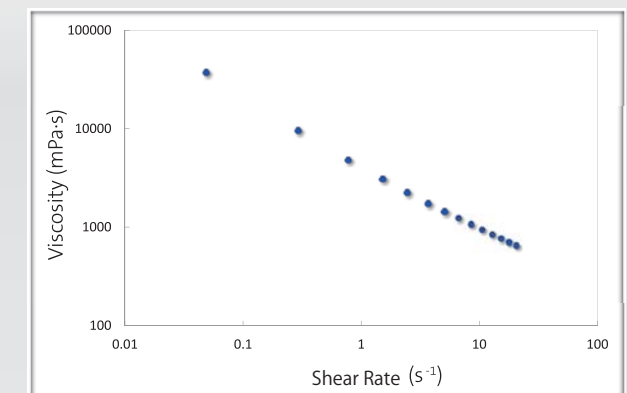


Viscosity vs. temperature (asphalt)

### Cosmetics

**Quality control of cosmetics**  
Reliable measurements of low viscous samples.

**Flow properties of lotions**  
Examination of thixotropy and shear-rate dependency of the viscosity.



Viscosity vs. shear rate (lotion)



## Specifications

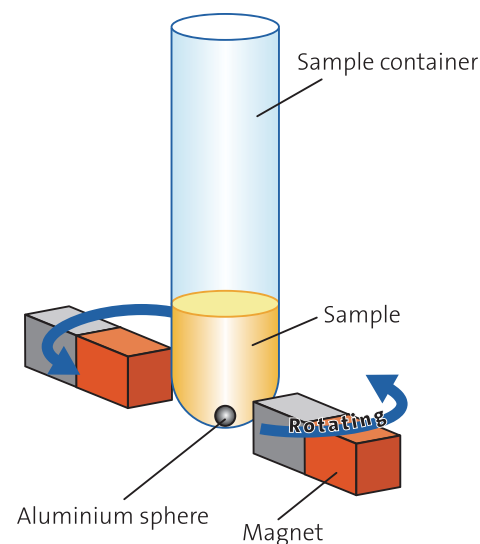
Item		
Device Name		EMS Viscometer Electro Magnetically Spinning Viscometer
Model Name		EMS-1000 S
Method of measurement		Electro Magnetically Spinning Method (EMS)
Viscosity measuring range		0.1 ... 1,000 mPa·s (sphere with $\phi$ 1.5mm,option) 0.1 ... 100,000 mPa·s (sphere with $\phi$ 2mm) 10 ... 1,000,000 mPa·s (sphere with $\phi$ 4.7mm,option)
Measurement	Repeatability	RSD within 3% (according to KEM's standard measuring conditions )
Minimum sample amount		300 $\mu$ L (sphere with $\phi$ 2mm) 700 $\mu$ L (sphere with $\phi$ 4.7mm, option) 90 $\mu$ L (Assay kit for 90 $\mu$ L container)
Temperature	Range	0 ... 200°C (the ambient temperature must not exceed 20°C for measurements at temperatures $\leq$ 10°C)
	Stability	$\pm$ 0.1°C
Motor speed	Range	500 ... 1,000rpm
	Stability	$\pm$ 3%
Ambient conditions	Temperature	10 ... 30°C
	Humidity	85%RH max. (no condensation)
Storage conditions	Temperature	-20 ... 60°C
	Humidity	85%RH max. (no condensation)
Power supply	Main unit	AC200...240V $\pm$ 10% or AC100...120V $\pm$ 10%
Power consumption	Main unit	Approx. 150W (MAX. 600W)
Dimensions	Main unit	374(W) x 347(D) x 335(H)mm
Weight	Main unit	Approx. 24kg

## Measuring Principle

The EMS viscometer is based on a new measuring principle using the University of Tokyo patent

In a sample container an aluminium sphere is submerged in the sample to be measured.

The aluminium sphere is located in the center of a rotor equipped with magnets which create a rotating magnetic field. The rotating magnetic field induces eddy currents in the sphere. The resulting Lorentz interaction between the magnetic field and these eddy currents generate torque that rotates the sphere. The aluminium sphere is thus driven contact free. The rotational speed of the sphere depends on the sample's viscosity. The viscosity of the sample  $\eta$  is calculated based on the angular velocity of the sphere.



Schematic diagram

Patent application No.5093599, US 8,365,582 B2,  
Applicant name: The University of Tokyo

## Standard Accessories

No.	Item Code		Remarks
1		AC power code	
2	64-00643-06	USB 2.0 cable, L= 1.8 m (USB2-AMBM-06)	A-B male type
3	66-00160-01	Stand for measuring cell	
4	66-00158	Storage container for spherical probes	
5	66-00157-01	Plastic tweezers	
6	12-05289	Fuse 6.3A	
7	12-05081-02	Assay kits (50 pieces)	Consisting of 50 test tubes, spheres( $\phi$ 2 mm), caps and seals
8	12-05245-03	Aluminum Spheres, $\phi$ 4.7 (50 pieces)	
9	20-05627	Inspection card / Warranty card	
10	12-07592	EMS-1000S operation manual (USB)	USB memory stick with EMS-1000S operation manual and PC software

Note: Control PC is to be prepared locally.

## Consumables

No.	Item Code		Remarks
1	12-05081	Consumables required for 100 measurements	items 2 and 3
2	12-05081-01	Sample containers, $\phi$ 13 mm, 100 pieces	
3	12-05245	Aluminium spheres, $\phi$ 2 mm, 100 pieces	
4	12-05245-01	Aluminium Spheres, $\phi$ 4.7mm, 100 pieces	
5	12-05269	Screw caps, 100 pieces	for sample containers $\phi$ 13 mm
6	12-05270	Seals, 100 pieces	for sample containers $\phi$ 13 mm

## Options

In order to meet specific requirements, we offer the options below.

For more information please contact one of our sales offices or your local dealer.

No.	Item Code	
1	12-07597	Key code for using $\phi$ 1.5 Sphere (ROM)
2	12-05245-04	Aluminum Spheres, $\phi$ 1.5, 100 pieces
3	12-07587	Assay kit for Titanium Sphere
4	12-05245-05	Titanium Spheres, $\phi$ 4.7, 100 pieces
5	12-07590	Assay kit for 90 $\mu$ L container
6	12-05272	Dry air unit
7	12-05276	Compressor

### Viscosity measurement of very low viscous samples

$\phi$  1.5 aluminum spheres is newly developed for measuring very low viscous samples. To enable the instruments to measure with this type of sphere, a ROM containing the corresponding key code is required.

### Measurements at 0 °C

When performing measurements at a temperature below ambient temperature condensation inside the instrument must safely be ruled out. If there is no source of dry air available for this purpose, a special compressor and a dry air unit which are available as options can be used.