

# Focusing on ease of use



## EMS-1000

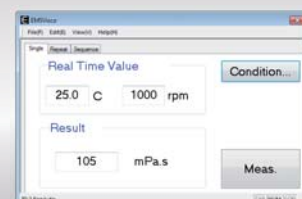
Electro Magnetically Spinning Viscometer

### Preparation



Fill 300  $\mu$ L of the sample  
in the sample container

### Measurement



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

### Cleaning



No cleaning required –  
increased efficiency



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# Features

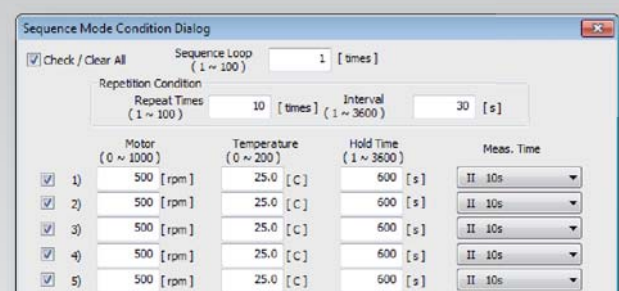
## A new approach for viscosity determinations

The EMS Viscometer measures the viscosity of liquids through observation of the rotation of a sphere which is driven by electromagnetic interaction. This new contact free viscometer was developed in collaboration with Institute of Industrial Science, the University of Tokyo within the framework of a JST Japan Science and Technology Agency.

## Wide Temperature Range

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

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



## Wide Measuring Range

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

The standard measuring cell covers the entire viscosity range – no need to use different types of rotors.

low viscosity		high viscosity
water	blood	polymers   resin
solvents	protein	bitumen
ink	beverage	heavy oil

## Short Measuring Time

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

Approx. 1 minute is required 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)

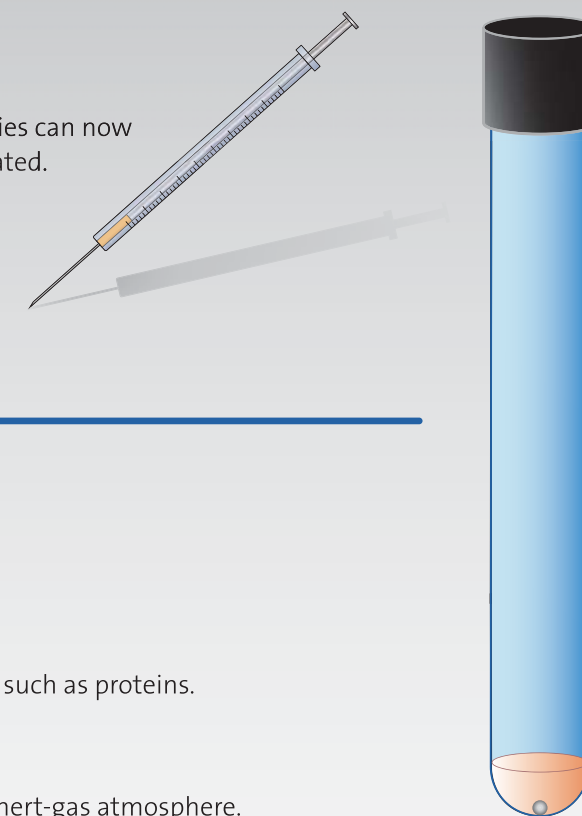
The shear rate can be varied by changing the rotational speed of motor, flow curves can be determined.

EMS-1000  
Electro Magnetically Spinning Viscometer

## Suitable for Very Small Samples

**Sample volume required:** 300 µL

Measurements of samples which are available in very small quantities can now be performed. During measurement the samples are not contaminated. Samples can be used for other purposes after measurement.



## Versatile Measuring Container

### 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 vessel. This allows to perform measurements in an inert-gas atmosphere.

## Versatile Software

The EMS Viscometer is operated and controlled by a personal computer. Viscosity measurements at a fixed motor speed and temperature can directly be started with one click.

To study the physical properties of products in the research and development phase, measuring cycles consisting of freely definable measuring sequences with different temperatures and/or motor speed can be set up.

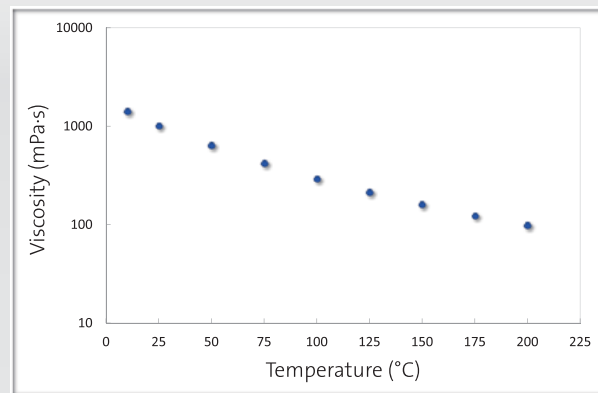


# Applications

## A wide range of unprecedented applications

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

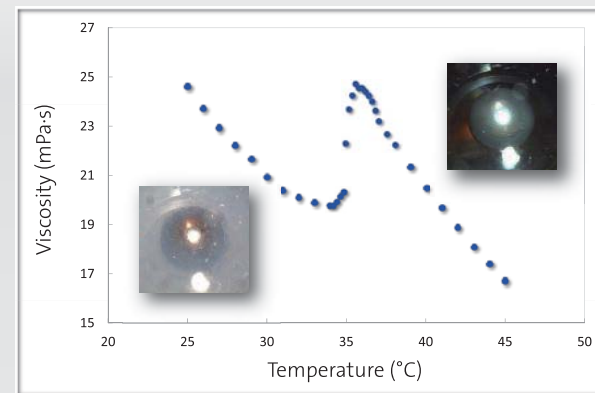
Heating up from room temperature to 200°C within 10 minutes: Studies of the temperature dependency of the viscosity have never been that quick and easy.



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.

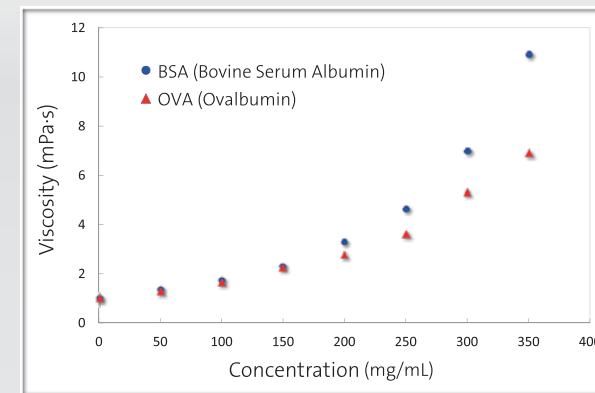


Viscosity change at phase transition temp. (liquid crystal)

### 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.

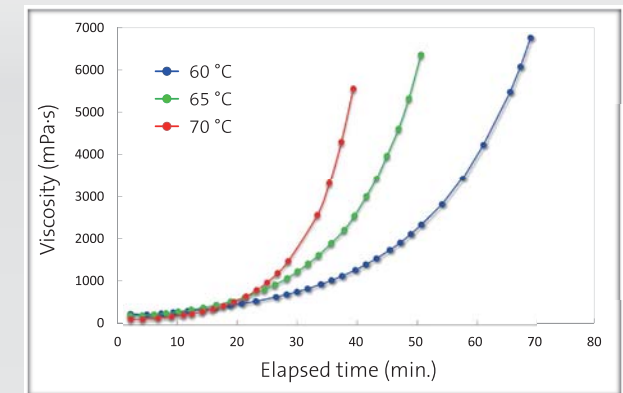


Viscosity vs. concentration (protein)

### Polymers

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

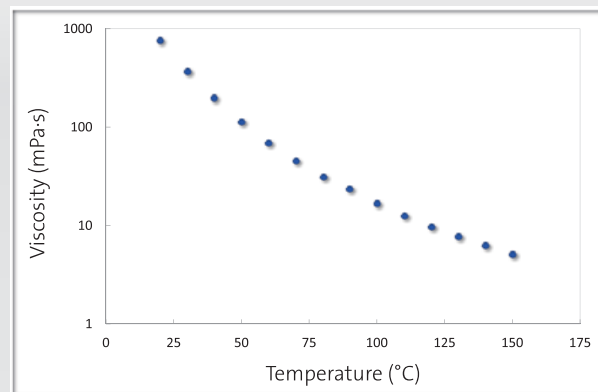
**Thermosetting resins**  
Examination of the flow properties during polymerization process. No cleaning required after measurement.



Curing process (epoxy resin)

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

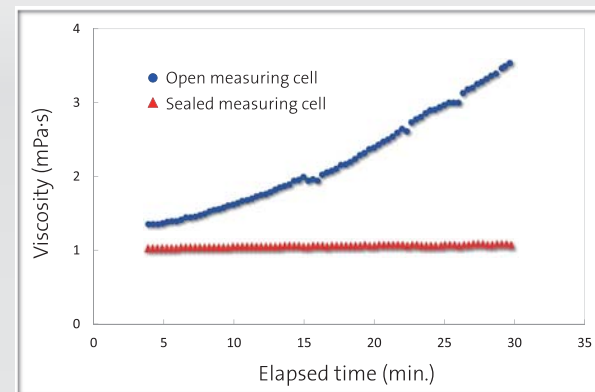
A completely sealed measuring makes sure you can measure all types of samples, regardless of whether they are toxic, highly hygroscopic, volatile or very sensitive to oxygen.



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.

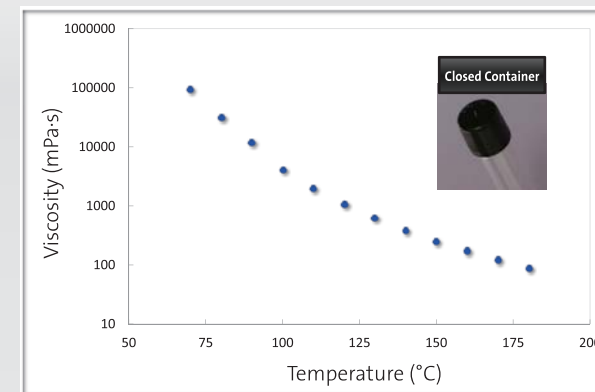


Viscosity at boiling temperature (glycerol)

### 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.

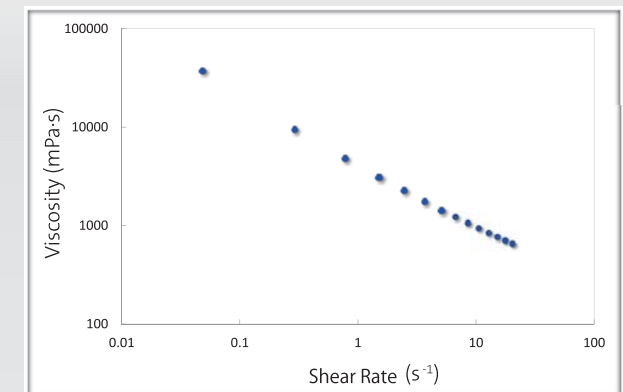


Viscosity vs. temperature (asphalt)

### 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		Designation
Device Name		EMS Viscometer Electro Magnetically Spinning Viscometer
Model Name		EMS-1000
Method of measurement		Electro Magnetically Spinning Method (EMS)
Viscosity measuring range		0.1 ... 100,000 mPa·s (sphere with $\phi$ 2 mm) 10 ... 1,000,000 mPa·s (sphere with $\phi$ 4.7 mm,option)
Measurement accuracy	Repeatability	RSD 3% (according to KEM's standard measuring conditions )
Minimum sample amount		300 $\mu$ L (sphere with $\phi$ 2 mm) 700 $\mu$ L (sphere with $\phi$ 4.7 mm, option)
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 ... 1,000 rpm
	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	AC 200...240V $\pm$ 10% or AC 100...120V $\pm$ 10%
Power consumption	Main unit	Approx. 150 W (MAX. 600 W)
Dimensions	Main unit	374 (W) x 347 (D) x 335 (H) mm
Weight	Main unit	Approx. 24 kg

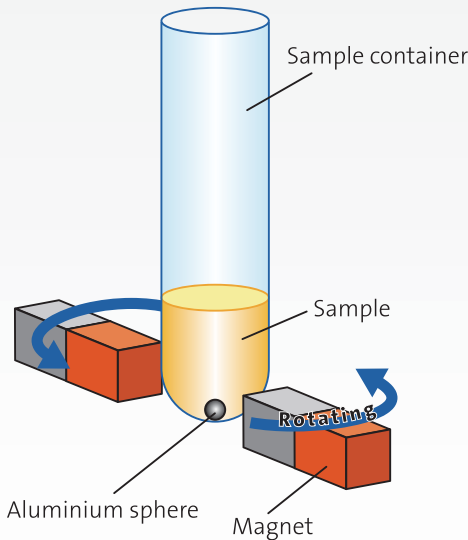
Measuring Principle

The EMS viscometer is based on a new measuring principle developed by Keiji Sakai, professor at Institute of Industrial Science, the University of Tokyo.

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.

(Patent 5093599, US 8,365,582 B2)



Schematic diagram

Standard Accessories

No.	Item Code	Designation	qty.	Remarks
1		AC power code	1	
2	64-00643-06	USB 2.0 cable, L= 1.8 m (USB2-AMBM-06)	1	A-B male type
3	12-05289	Fuse 6.3 A	2	
4	66-00157-01	Plastic tweezers	1	
5	66-00158	Storage container for spherical probes	1	
6	66-00160-01	Stand for measuring cell	1	
7	12-06097	EMS-1000 operation manual (USB)	1	USB memory stick with EMS-1000 operation manual and PC software
8	59-00405	Safety Instructions	1	
9	12-05081-02	Assay kits (50 pieces)	1	consisting of 50 test tubes, spheres ( $\phi$ 2 mm), caps and seals
10	20-05627	Inspection report, certificate	1	

Note: Control PC is to be prepared locally.

Consumables

No.	Item Code	Designation	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	12-05269	Screw caps, 100 pieces	for sample containers $\phi$ 13 mm
5	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	Designation
1	12-05336	Key code for measuring range extension (ROM)
2	12-05245-01	Aluminium spheres, $\phi$ 4.7 mm, 100 pieces
3	12-05272	Dry air unit
4	12-05276	Compressor

Viscosity measurements of very highly viscous and dark samples

Highly viscous (viscosity  $\geq$  100,000 mPa·s) and dark or opaque samples (like e.g. asphalt) must be measured using an aluminium sphere with a diameter of 4.7 mm. This type of sphere also shortens the time required per measurement when measuring highly viscous samples. To enable the instrument 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