# SOM-A

Automatic Spread Oil Measuring Apparatus

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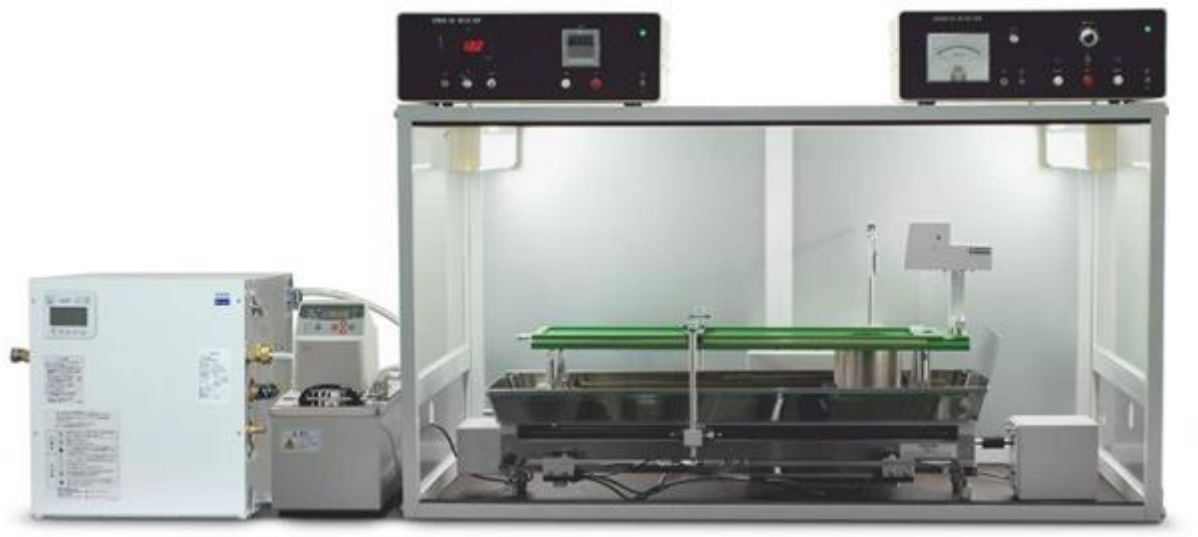
## ■ Outline and Features

During the production of rolled steel, tin or aluminum sheets, oils such as DOS, CSO or ATBC are being used as a coating medium to prevent sheets from rusting. Monitoring the amount of the oil coated on the sheets is essential to ensure the production of high-quality metal sheets.
Using test metal sheets from the production line, the SOM-A determines the oil amount by transferring the oil coated on the rolled metal test sheets onto a water surface and detecting the change of the surface film pressure. This method is called “hydrophil balance method”



- The SOM-A utilizes the Wilhelmy plate method to precisely detect the surface film pressure and to determine the oil volume in the range of μg on a test metal sheet
- Two independent temperature control systems ensure reliable results and high repeatability even in difficult measuring environments
- The oil volume is indicated on a LED display in either mg/m$^2$ or g/BB
- The Teflon-coated trough has an excellent corrosion resistance and is easy to clean
- Periodical calibration of the balancing system can easily be done by user
- The measuring probe (glass plate) can easily be cleaned

## ■ Partial list of customers

**Domestic:**

Nippon Steel & Sumitomo Metal / JFE Steel / Kobe Steel / Furukawa Electric / UACJ / Showa Aluminum Can / Toyo Seikan / Toyo Kohan

**International:**

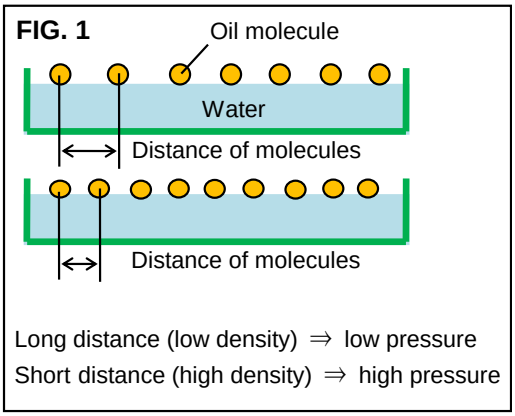
Ton Yi Industrial (Taiwan & China) / China Steel (Taiwan) / Pohang Steel (Korea) / Shin-Hwa Silup (Korea) / Perstima Tinplate (Malaysia, Vietnam) / Baoshan Iron & Steel (China) / Eregli Iron & Steel Works (Turkey) / Siderar S.A.I.C. (Argentina) / Siam Tinplate (Thailand) / UACJ (Thailand) / Tinplate Company of India

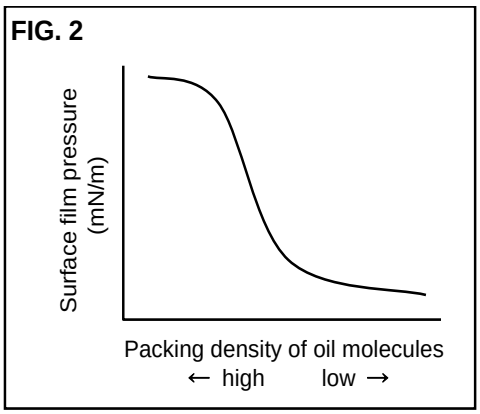
## ■ Principle

Most oils have the characteristic to spread uniformly on the water surface as a monomolecular film or monolayer if the area is large enough for the oils to spread freely. By controlling the packing density of oil molecules, which spread as a monolayer on the water surface, per unit area, the oil volume can be determined from the relationship between the spread area and the diameter of the oil molecules.

### How is the uniform density of oil molecules being controlled?

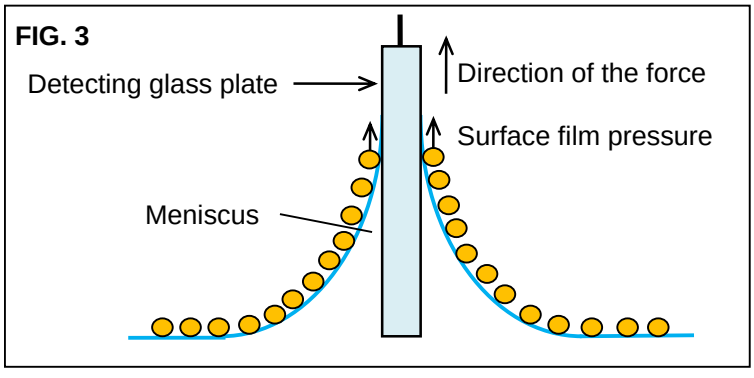
Monolayers are characterized by their surface film pressure. Reducing the surface area will compress the molecules of a monolayer, which will result in a higher density of molecules and a higher surface film pressure (Fig.1). The relationship between the surface film pressure and the area per molecule is shown in the surface pressure-area curve (Fig.2).
By setting the surface film pressure of the SOM-A just before the collapse of the monolayer, the uniform density of oil molecules can be controlled. Usually, the maximum surface pressure is set to 8 mN/m. It is also called Torque Angle.




### How is surface film pressure being measured?

When the measuring probe (glass plate) is immersed in the water subphase, the water is wetting the glass plate and creates a concave meniscus (Fig.3). The oil molecules are arranged on the water surface and build the surface film pressure. This pressure forces the glass plate to move upwards, which can be detected by the precise balancing system.



## ■ Specifications

### <Main Unit>

| | |
|---|---|
| Power requirements | AC100V Single Phase, 50/60Hz, 2.7kVA |
| Dimensions | 1,300(W) x 650(D) x 860(H)mm (excluding water circulator and water supply system) |

We recommend using purified water as filling water. (In the case of using tap water; the flow rate should be higher than 1L/min, the water pressure stable and the diameter of the water tap within ϕ15 to ϕ15.5mm).
*Salt water cannot be used on this standard system.

### <Components>

#### Oil Volume Meter (Operation Box B)

For displaying the oil volume and operating the automatic sample dipping unit. 3 oil types can be set.

| | |
|---|---|
| Measuring range | 0.3-17.5mg/m$^2$ |
| Digit & Resolution | 0.1mg/m$^2$ |
| Display method | LED digital display |
| Accuracy | ±2%FS (based on +35°C) |

Data is based on both faces measurement of a specimen size of ϕ57.3mm and DOS oil. Unit “g/BB” is also possible. The actual oil volume on the specimen must be within the range of 0.7-50.0μg.

#### Automatic Surface Film Pressure Meter (Operation Box-A & Detecting Section)

For detecting the surface film pressure, displaying results, setting the torque angle and operation of the film pressure compressing unit.

| | |
|---|---|
| Measuring method | Wilhelmy Plate method |
| Measuring range | 0-50.0mN/m (Analog meter) |
| Accuracy | ±0.5%FS |

#### Oil Film Spreading Trough

Trough to be filled with water, on whose surface the oil will be spread. The trough is Teflon-coated for excellent water-repellency, equipped with an internal circulation system for temperature control and has four level adjustment legs.

| | |
|---|---|
| Internal dimensions | 700(W) x 140(D) x 5(H)mm |
| Cylinder section size | ϕ90 x 90(D)mm |

#### Film Pressure Compressing Unit & Drive Motor

Drive motor unit for the barrier to compress the area of the spread out oil. A drain pan is also included.

| | |
|---|---|
| Compressing speed | 300mm/min (fixed) |
| Dimension | 1,120(W) x 280(D) x 220(H)mm |

#### Environmental Chamber

Chamber to protect the measurements from wind and dust. It consists of a metal frame with two glass panel slide-doors and two fluorescent light sources.

| | |
|---|---|
| External dimensions | 1,300(W) x 650(D) x 700(H)mm |

#### Automatic Sample Dipping Unit

Equipment for holding the test specimen and repeatedly immersing it into the water by up/down motion to transfer the oil on the sample onto the water surface.

#### Refrigerating and Heating Water Circulator

Circulator for temperature control of the trough.

| | |
|---|---|
| Temperature range | 5°C above RT to +95°C |
| Control accuracy | ±0.05°C |
| Control method | PID |
| Safety functions | Diagnosis functions (max/min temperature abnormality, heater breakage, sensor abnormality) |
| Heater capacity | 1kW (SUS316L) |
| Bath volume/material | 5.5L/SUS304 |
| Circulation pump | Max.5L/min |
| Tube Dia. of inlet/outlet | ϕ10.5 |
| External dimensions | 194(W) x 306(D) x 359(H)mm |
| Power consumption | 1.1kVA |

#### Heated Water Supply System

For temperature control of water for oil spreading.

| | |
|---|---|
| Temperature range | About +35°C to +70°C |
| Control accuracy | ±5.0°C |
| Control method | Thermistor |
| Safety functions | Temperature fuse, manual reset |
| Heater capacity | 1.1kW |
| Pressure | 0.08MPa |
| Bath volume | 25L |
| External dimensions | 434(W) x 395(D) x 395(H)mm |
| Weight | About 38kg (being water-filled) |

#### Standard Accessories

| | |
|---|---|
| Teflon coated barrier | 2 pcs (STD) + 2 pcs (spare) |
| Micro-syringe 250μL | 1 pce (STD) + 2 pcs (spare) |
| Glass plate | 1 pce (STD) + 14 pcs (spare) |
| 200mg calibration weight | 1 pce (STD) + 1 pce (spare) |
| Tubes | 1 Pressure resistant vinyl tube (ϕ15mm x 5m)<br>1 Silicon tube (ϕ10mm x 10m) |

*The specifications and designs are subject to change without notice. 1803