

Portable Total Hemispherical Emittance Measurement System PM-E2

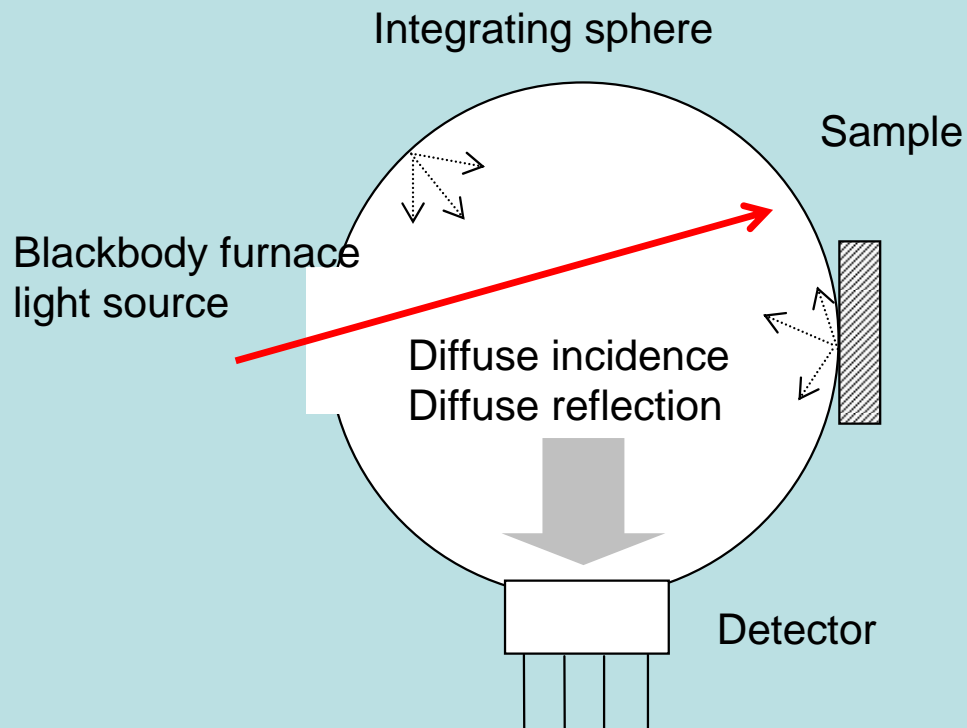


Measurement section with blackbody furnace, and Integrating sphere detector attached

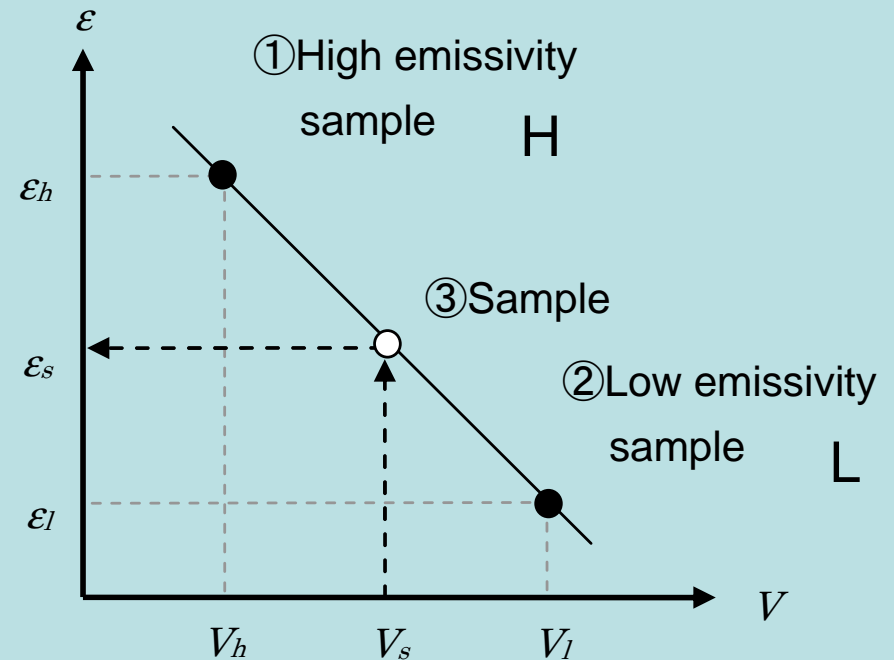
Operation and display section

Measurement Principle

- Measurement procedure
- ① High emissivity sample
 - ② Low emissivity sample
 - ③ Sample



Concept of measurement section



Measurement principle

Characteristics PM-E2

- High accuracy measurement of total hemispherical emittance.
- Measurable from small size sample to large panel.
- Simple operation, small size, light weight, and cheap.
- Shortening of the measurement time.
- Evaluation data by calorimeter method(isas).

Main Specification

System	
System components	<ul style="list-style-type: none"> • Measurement system - Blackbody furnace : 330K - Integrating sphere (diameter: 30mm, Gold plate inner surface) - Thermopile sensor : wavelength range 0.6~42 μ m (Cover 95 % of the total emissive power of the ideal blackbody at 300K) • Data acquisition system - Hemispherical total reflective intensity
Measurement method	Total hemispherical emittance
Uncertainty	<ul style="list-style-type: none"> • Agreed within ± 0.05 (Total hemispherical emittance) • Repeatability : 0.02 (Total hemispherical emittance)
Measuring time	Around 2~5minutes
Reference sample	<ul style="list-style-type: none"> • Low emissivity sample: Deposited Gold $\epsilon_L=0.05@293K$ or Deposited Al tape • High emissivity sample: Black Kapton $\epsilon_H=0.85@293K$
Power source	AC100V with adapter (+ DC12V1A)
Dimension (Weight)	<ul style="list-style-type: none"> • Operation section : W82 \times H32 \times D145mm (0.2kg) • Measurement section : W60 \times H74 \times D125mm (0.7kg) • Measurement window : diameter 10mm

Measurement Condition

- The measurement should be performed at a stable room temperature (20°C or more). And the air conditioning wind does not hit the measurement section and samples directly. If there is convection etc, it is recommended to measure in a simple booth.

And when the room temperature is 15°C or less, please wrap the measurement section with thermal insulation (Fig.A).

- It is recommended to measure about 1 hour after turning on the power (after 2 hours if possible).
- Please attach a thin sample (Tape, Solar cell) to a copper plate or Al plate with a thickness of 0.5 mm.

Measurement Preparation 1

- A. Small size sample (Coating, Metal, Cover glass, Solar cell, etc.)
- Three samples of high and low reference sample and measurement sample are arranged vertically on the insulating board (Fig.1).
 - Set the Measurement section on the three samples and make them isothermal(Fig.2).

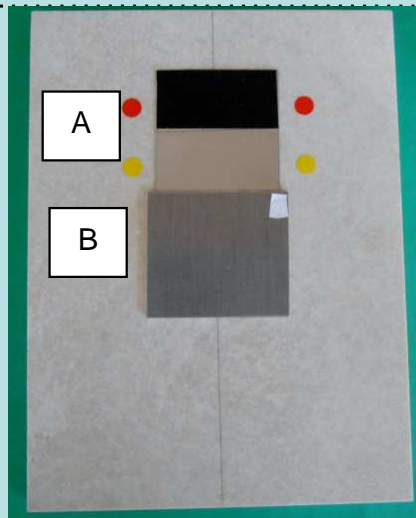


Fig.1

A : High & Low reference sample
B : Measurement sample



Fig.2

Measurement preparation 2

B. Large size sample (Solar cell panel, Equipment, etc.)

- Set high and low reference samples on a large panel, place the Measurement section on them and isotherm.



A : High and low reference samples

B : Large size panel



Fig.A

Measurement Procedures

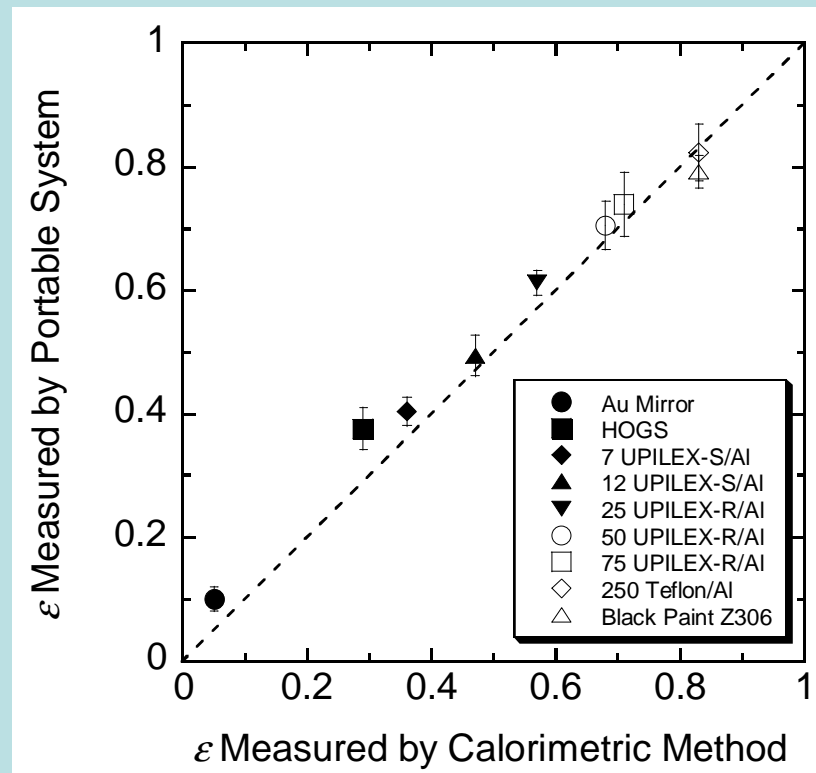
- ① Calibration of the high and low reference samples
High sample ($\varepsilon_H = 0.85$) Low sample ($\varepsilon_L = 0.05$)
- ② Check of the high and low reference samples
 $\varepsilon_H = 0.85 \pm 0.01$, $\varepsilon_L = 0.05 \pm 0.01$
Yes, go to ③, No, go to ①
- * At the start of measurement, it is recommended to repeat ① and ② about three times.
- ③ Sample measurement
Please check measurement result. Rerun ② and ③
- * In the case of a metal film deposited polymer film
Depending on the complex absorption characteristics and hygroscopicity of the polymer film, the value of ε may not be stable.
At that time please heat the sample at about 60 °C for about 5 minutes with a dryer etc.

Uncertainty PM-E2

▪ Influence by the temperature difference of light source and sample (Against Kirchhoff law)	0.02 under
▪ Measurement method of the total hemispherical emittance by the integrating sphere	0.03 under

Cross check of PM-E2 and calorimetric method

Samples	PM-E2	calorimetric method @293K
Au mirror	0.05	0.03
Graphite sheet	0.33	0.29
Deposited Al Upilex25R	0.54	0.57
Germanium	0.64	0.69
Deposited Al Upilex75R	0.72	0.71
Black paint	0.83	0.77



Comparison with Other Instruments

Sample	Calorimetric (isas) *	PM-E2	TESA2000	TSS-5X	D&S AERD
	<i>H</i>	<i>H</i>	<i>H</i>	<i>N</i>	<i>N</i>
Deposited Al Upilex25R	0.57@20°C	0.56-0.58 @27°C	0.66	0.64-0.66	0.59-0.64
Deposited Al Upilex50R	0.68@20°C	0.67-0.69 @27°C	0.77	0.74-0.77	0.72-0.75

* Calorimetric method is reference measurement method.

Delivery Performances

1	JAXA isas	
2	Panasonic	2011
3	NTspace	2012
4	Hokkaido University	2012
5	Toshiba	2013
6	Nagoya University	2014
7	Korea Aerospace Research Institute	2014
8	Asahi Glass C	2016