

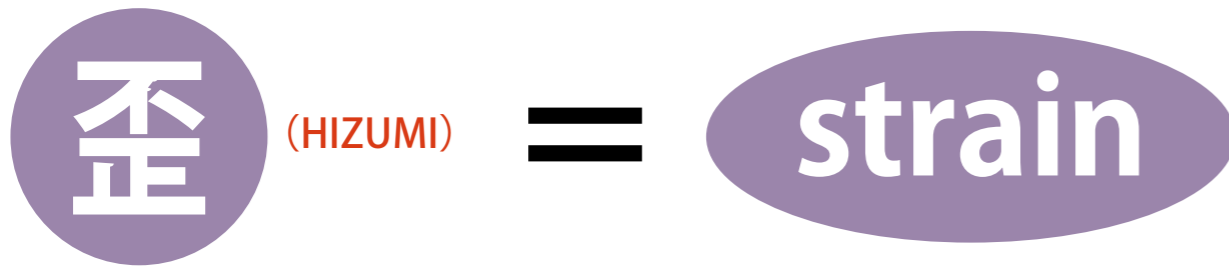
# Polariscopes

## LSM product line-up



High sensitive polariscope by professional optical manufacturer  
Strain view, stress direction analysis, quantitative measurement  
in a product made from glass or plastics.

Japanese has this kanji word.  $\longrightarrow$  What is this word called in English?



As a word, there are several images for "strain".  
 What do you think about right image of "HIZUMI = strain" ?  
 The most suitable image is abstracted from a dictionary.

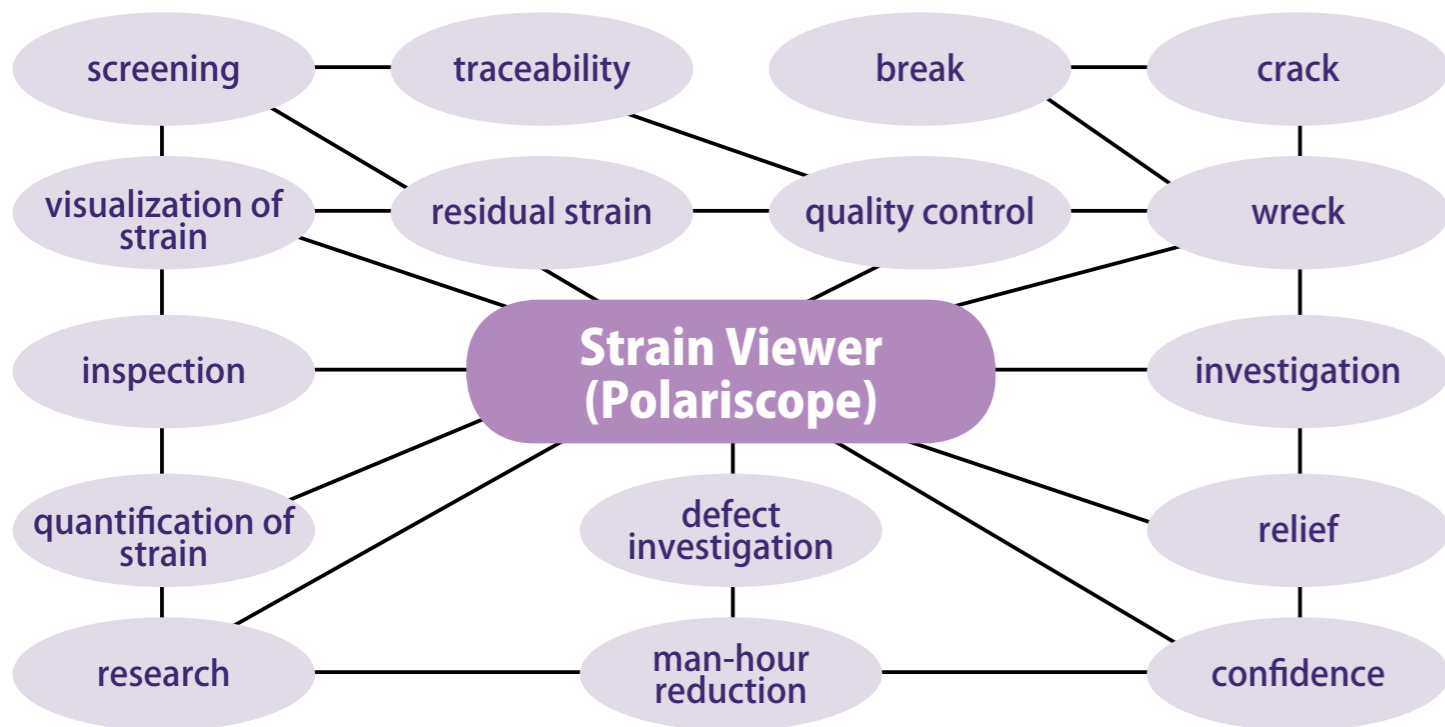
strain: physical pressure [uncountable, countable] the pressure that is put on something when a physical force stretches, pushes, or pulls it (Oxford Advanced Learner's Dictionary 9th edition).

Although strain occurs in metal and wood, LUCEO focuses on strain occurred in transparent body. Following 4 products are major examples of transparent body.

- glassware
- resin film
- plastic product
- crystalline material

LSM product family, Strain Viewer (Polariscope), provides solutions

for **strain** in transparent body.



LSM : Initials of Luceo Strain Meter

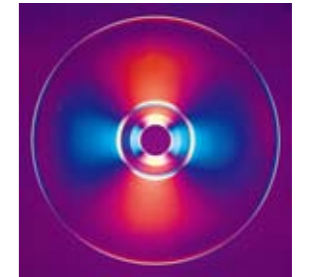
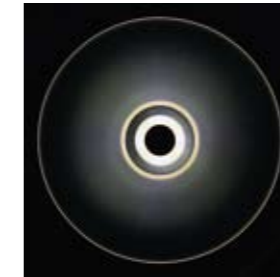
Inspection method

<<< There are 5-ways in 2-types of inspection method for polariscopes >>>

Observational method

Observe presence/absence, distribution state, feature and direction of strain in transparent body. For example, mold injection product of an optical disk is seen like below pictures according to inspection method. (Observation object: transparent CD disc)

- Crossed Nicols method
- Circularly Polarized method
- Sensitive Color method



Measurement method

Numerical value and direction of strain are quantified.

- Senarmont method
- Rotating Analyzer method
- RGB Linear Polarization Method

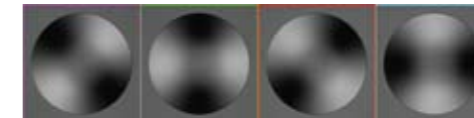
Calculates strain by finding the angle of the darkest portion of the brightest part in a sample as rotating an analyzer.

Calculates value and direction of strain by rotating an analyzer at previously defined angles based on change of brightness.

Rotates the polarizing plate at a specified angle while maintaining the orthogonal and parallel positions, and calculates the magnitude and direction of distortion from the change in brightness.



(Halogen lamp)



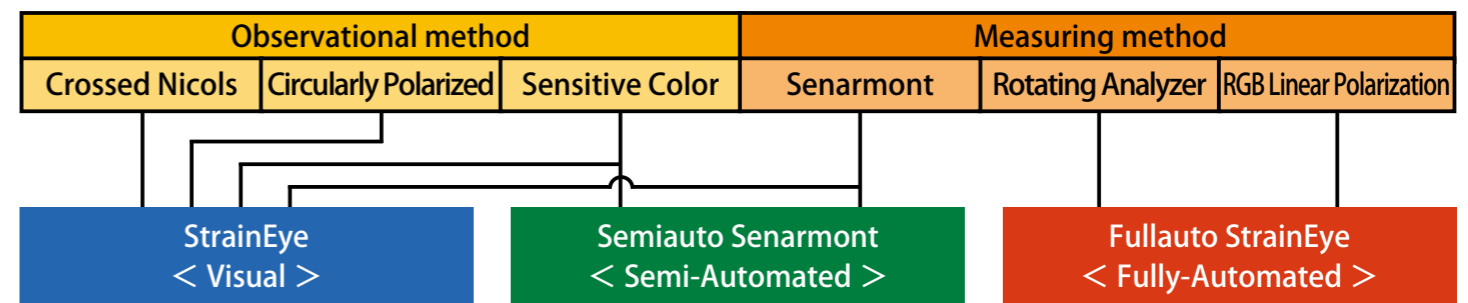
(Lens)



(Crystal glass)

Type of polariscope

<<< 3-families of polariscopes according to inspection method >>>



Visual inspection

More precise with PC analyzing

2D whole measurement

StrainEye is the registered brand that means "see strain by an eye" or "an eye to see strain".

StrainEye < Visual >

LSM-1000LE (Handheld)

Lighting area :  $\Phi$  78mm



LSM-1000LE : Crossed Nicols Sensitive Color Senarmont

- (Inspection method is changeable by replacing a wave plate)
- Suitable for a small-sized sample inspection.
  - Battery operation available.
  - Carriageable with the handle.
  - Easy to check edge conditions of large glass.

LSM-2000LE (Portable)

Lighting area :  $\square$  120mm



LSM-2100LE : Crossed Nicols  
LSM-2200LE : Circularly Polarized  
LSM-2300LE : Sensitive Color

- Tilted lighting area enables to inspect seating in a chair.
- Suitable for a small-sized sample inspection.
- 1set/person by reasonable price.

LSM-4000LE family (Medium)

Lighting area :  $\square$  150mm

Lighting are :  $\square$  200mm

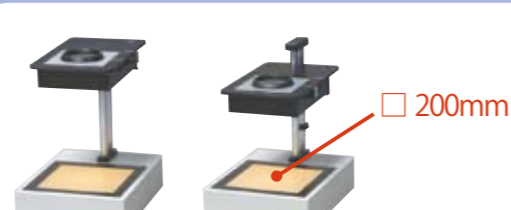
- Select with/without height adjustment of analyzer.

LSM-4\*00LE : without height adjustment  
LSM-4\*01LE : with height adjustment



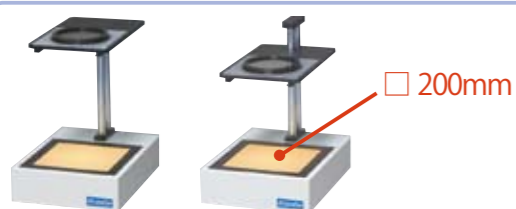
LSM-4100LE LSM-4101LE : Crossed Nicols  
LSM-4200LE LSM-4201LE : Circularly Polarized  
LSM-4300LE LSM-4301LE : Sensitive Color  
(Select a model by inspection method)

- Suitable for a medium-sized sample.
- Standard size among visual inspection models.



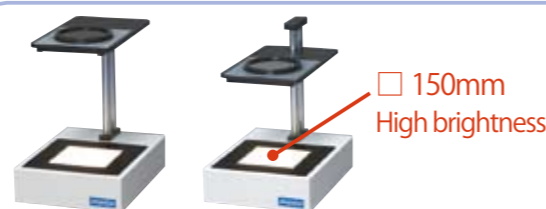
LSM-4410LE LSM-4411LE : Sensitive Color Senarmont

(Inspection method is switchable by sliding the lever)



LSM-4400LE LSM-4401LE : Crossed Nicols Sensitive Color Senarmont

(Inspection method is changeable by replacing a wave plate)



LSM-4400B LSM-4401B : Crossed Nicols Sensitive Color Senarmont

(Inspection method is changeable by replacing a wave plate)

LSM-8000LE family (Large)

Lighting area :  $\square$  350mm

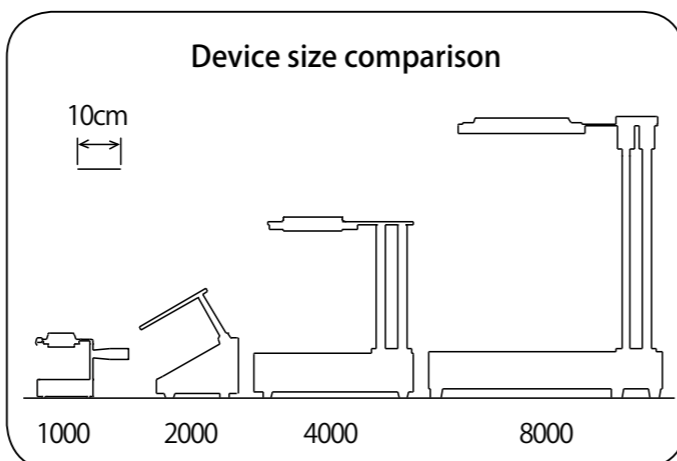


LSM-8200LE : Circularly Polarized  
LSM-8400LE : Crossed Nicols Sensitive Color Senarmont

(Inspection method is changeable by replacing a wave plate)

- Suitable for a large-sized sample.
- Analyzer height is adjustable.

Device size comparison



Semiauto Semarmont < Semi-Automated >

LSM-7000LE

Image range :  $176 \times 132 \sim 6.9 \times 5.2\text{mm}$



Standard zoom lens is provided.

<inspection method> Sensitive Color Senarmont

- Suitable for a small ~ medium-sized sample.
- Analyzer height is adjustable.

LSM-7000B

Image range :  $150 \times 112 \sim 6.9 \times 5.2\text{mm}$



Standard zoom lens is provided.

<inspection method> Sensitive Color Senarmont

- Suitable for a small ~ medium-sized sample with deep colored.
- Analyzer height is adjustable.

LSM-7000BZ

Image range :  $13.0 \times 9.8 \sim 2.0 \times 1.5\text{mm}$



High magnification zoom lens is provided.

<inspection method> Sensitive Color Senarmont

- Best for a very small-sized sample.
- Analyzer height is adjustable.

Fullauto StrainEye < Fully - Automated >

LSM-9000LE

Measurement area :  $\square$  175mm

Prime lens is provided.  
<inspection method> Rotating Analyzer method

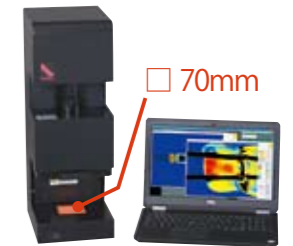


- Suitable for a small ~ medium-sized sample.
- Measurable retardation range :  $0 \sim 130\text{nm}$

LSM-9000S

Measurement area :  $\square$  60 ~ 10mm

Zoom lens is provided.  
<inspection method> Rotating Analyzer method

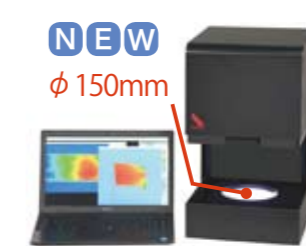


- Suitable for a small-sized sample.
- Measurable retardation range :  $0 \sim 130\text{nm}$

LSM-9100W

Measurement area :  $\phi$  150mm

Prime lens is provided.  
<inspection method> RGB Linear Polarization method



- Suitable for a small ~ medium-sized sample.
- Measurable retardation range :  $0 \sim 3,000\text{nm}$

LSM-9100WS

Measurement area :  $\square$  60 ~ 10mm

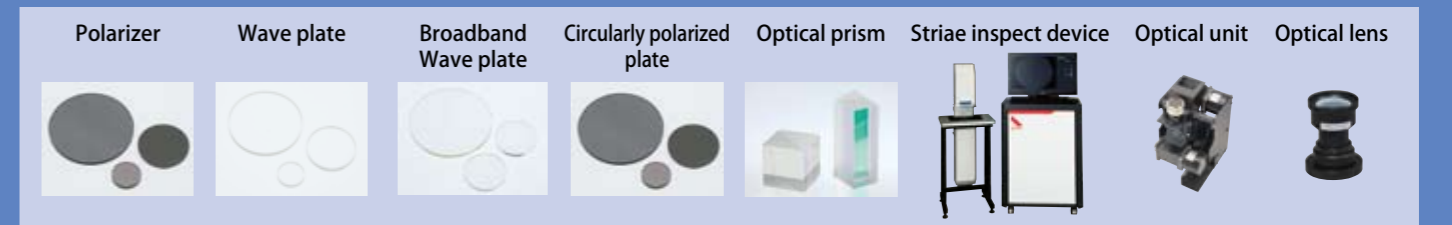
Prime lens is provided.  
<inspection method> RGB Linear Polarization method



- Suitable for a small-sized sample.
- Measurable retardation range :  $0 \sim 3,000\text{nm}$

LUCEO has been a specialist of optical instruments for over 50 years from its establishment.

LUCEO is the pioneer who produces polarizers and wave plates by gluing in-house optical films to optical glass plates. We provide product portfolio taking advantage of polarization technologies adapting to the changing social needs consistently.



In LUCEO showroom, you can experience demonstrations of inspection and measurement looking closely at our various products.

Polariscopes LSM products Specification list

items		StrainEye											Semiauto Senarmont			Fullauto StrainEye			
		Handheld	Portable			Medium				Large (8000)									
		LSM-1000LE	LSM-2100LE	LSM-2200LE	LSM-2300LE	LSM-4100LE LSM-4101LE	LSM-4200LE LSM-4201LE	LSM-4300LE LSM-4301LE	LSM-4400LE LSM-4401LE	LSM-4400B LSM-4401B	LSM-4410LE LSM-4411LE	LSM-8200LE	LSM-8400LE	LSM-7000LE	LSM-7000B	LSM-7000BZ	LSM-9000LE	LSM-9000S	NEW LSM-9100W
Inspection Method	Crossed Nicols	●	●			●			●			●							
	Circularly Polarized			●			●				●								
	Sensitive Color	●			●			●	●	●		●		●					
	Senarmont	●							●	●		●		●					
	Rotating Analyzer															●			
	RGB Linear Polarization																		●
Retardation Range	Re:0~270nm	-	-	-	-	-	-	-	Re:0~270nm	-	Re:0~270nm	-	Re:0~270nm	-	Re:0~270nm	Re:0~130nm	Re:0~3,000nm		
Repeat Accuracy	-	-	-	-	-	-	-	-	-	-	-	-	-	Approx.±1.5nm	σ = 1nm	σ < 3nm			
Measurement Area (mm)	φ 78	120×120			200×200				150×150	200×200	350×350		MAX:176×132 MIN:6.9×5.2	MAX:150×112 MIN:6.9×5.2	MAX:13.0×9.8 MIN:2.0×1.5	175×175	MAX:60×60 MIN:10×10	φ 150	MAX:60×60 MIN:10×10
Effective Pixels (Pixel)	-	-	-	-	-	-	-	-	-	-	-	-	640×480			1100×1100			
Set Wavelength	Senarmont :540nm	-	-	-	-	-	-	-	Senarmont :540nm	-	Senarmont :540nm	-	Senarmont :540nm	Senarmont :540nm			590nm	465nm 525nm 635nm	
Light Source	High Brightness LED White 3000K	High Brightness LED White 3000K			High Brightness LED White 3000K					High Brightness LED White 3000K	High Brightness LED White 3000K			High Brightness LED					
Usable Dimension of Polarizer (mm)	φ 78	120×120			200×200				150×150 (High Brightness)	200×200	350×350		200×200	150×150 (High Brightness)		200×200	70×70	φ 150	70×70
Usable Dimension of Analyzer(AN) (mm)	φ 54	φ 84			φ 110		φ 114		φ 80	φ 200		φ 80			Built-in				
AN Height Adjustment		● (Available for LSM-xx01)								●	●								
Sample Available Height (mm)	70	115			300 65~290		285 55~275		250 25~240	80~500	65~500		25~200		25~90	130	70	160	115
Outer Dimension (W×D×H mm)	96×135×150 (Handle:L=85)	180×245×264			280×375×415				280×375×430		500×550×660		280×375×705			280×340×500	200×280×595	300×353×540	300×353×580
Weight (Body)	0.7kg	3.4kg			10kg		11kg		12kg	26kg		16kg			18kg	18kg	22kg	24kg	
Power	DC Input 15-24V 0.8A	DC Input 15-24V 0.8A			100-240VAC 50/60Hz 0.14A				100-240VAC 50/60Hz 0.3A	100-240VAC 50/60Hz 0.14A	100-240VAC 50/60Hz 0.77A		100-240VAC 50/60Hz 0.2A	100-240VAC 50/60Hz 0.3A		100-240VAC 50/60Hz 0.35A	DC Input 24V 1.5A	DC Input 24V 1.6A	
Power Consumption (Body)	15W	15W			14W				30W	14W	77W		20W	30W		35W	38W	40W	
Component	Body, (1/4waveplate, Sensitive Color plate)	Body			Body, Cables				Body, Cables, 1/4 wave plate, Sensitive Color plate	Body, Cables	Body,Cables, (8400LE: 1/4 wave plate, Sensitive Color plate)			Body, Computer, USB-Camera, Zoom Lens, Cable					
Attachment	AC Adapter, Sample Glass, (Battery Charger)	AC Adapter, Body Cover		AC Adapter, Body Cover, Sample Glass	Body Cover				Body Cover, Sample Glass			Body Cover	Body Cover, Sample Glass	Body Cover, Sample Glass			Body Cover	AC Adapter, Body Cover	
Computer OS	-	-	-	-	-	-	-	-	-	-	-	-	Windows10(64bit) Japanese/English			Windows10(64bit) Japanese/English			

# Polariscope LSM product line-up can inspect wide variety of strain in a product made from glass or plastics properly.



## ■ objects of polariscopes

### glassware

large float glass plate, automotive glass, industrial new material glass, optical new material glass, glass wafer, thermister, glass paste  
 glass tube <various types of lamps, electronic tube (vacuum tube, gas-enclosing tube), sealing glass tube for electronic component, combustion partition for heating appliance>  
 laboratory glassware <flask and beaker, test tube and connecting, tubule, analysis component, evaporating dish and watch glass, etc. >  
 material of optical glass <crystal, quartz, lens glass material, etc.>  
 optical glass element <optical filter, LD cover glass, ball lens, lens array, lens, prism, V-groove substrate, etc.>  
 glass container <bottle for beverage, wide-mouth bottle, preservation container, glass, dish, etc.>

### plastic(synthetic resin) products

large resin plate, resin film  
 mold injection resin products <LCD monitor cover, sun visor, resin container, etc.>  
 resin optical elements <lens array, lens, prism, etc.>

\*note:Please ask other kind of products without mention of the list. There are some of products that can be inspected by polariscopes.

## ■ use applications

products	use applications
large float glass plate	inspect belt-like strain at the edge of the glass caused during manufacturing process of float glass
automotive glass	inspect strain caused around metal electrode at bonding to glass
industrial new material glass	inspect strain in new glass at its development phase
optical new material glass	inspect strain in new glass at its development phase
glass wafer	inspect fine processing strain caused during its manufacturing process
thermister	inspect strain caused in contact with metal and glass condition setting for annealing treatment
glass paste	inspect strain caused by shrinkage after dissolution or anchoring
glass tube <various types of lamps, electronic tube(vacuum tube, gas-enclosing tube) sealing glass tube for electronic component, combustion partition for heating appliance>	inspect strain caused in contact with metal and glass inspect strain caused by influence after high thermal exposure inspect strain caused by thermal history around portion of highly thermal processed condition setting for annealing treatment inspection after annealing process
laboratory glassware < flask and beaker, test tube and connecting tubule, analysis component, evaporating dish and watch glass,etc. >	inspect strain caused by influence after high thermal exposure inspect strain caused by fire process condition setting for annealing treatment inspection after annealing process
material of optical glass <crystal,quartz,lens glass material,etc.>	inspect strain caused in manufacturing process of material condition setting for annealing treatment inspection after annealing process

products	use applications
optical glass element < optical filter,LD cover glass,ball lens,lens array, lens, prism, V-groove substrate >	inspect fine processing strain caused during its manufacturing process inspect strain caused by thermal history at mold press. condition setting for annealing treatment inspection after annealing process inspect strain caused by fitting a thing into a metal frame
glass container < bottle for beverage, wide-mouth bottle, preservation container, glass,dish >	inspect strain caused by forming condition setting for annealing treatment inspection after annealing process
large resin plate	inspect strain caused during manufacturing process of resin plate
resin film	inspect uniformity of strain in film
mold injection resin products < LCD monitor cover, sun visor, resin container, etc. >	inspect residual strain and orientational strain caused by mold injection condition setting for injection speed inspection after annealing process inspect strain caused by fitting a thing into a metal frame
resin optical elements <lens array,lens,prism, etc.>	inspect fine processing strain caused during its manufacturing process inspect strain caused by thermal history at mold press condition setting for annealing treatment inspection after annealing process inspect strain caused by fitting a thing into a metal frame