Fullauto StrainEye
Polariscope
LSM-9000LE

After setting sample, you only click the measurement button.
You can get 2D strain information easily.

High sensitive polariscope by professional optical manufacturer

luceo

For years, Luceo Co., Ltd. has maintained the highest quality in polarization technology. After years of research and investment, we have now put a fully automatic polariscope on the market.

Luceo Co., Ltd. has been developed polarization technology for a long time, and now supplies a fully automatic polariscope as a strategy product, bringing original technology to the market.

Fullauto StrainEye LSM-9000LE is a fully automatic 2D-measuring device which measures retardation values and the direction of a slow axis in a transparent body having strain and birefringence therein.

In order to measure direction and birefringence, conventionally the visual observation type polariscope using the Senarmont method is used. As well, our in-house manufactured product, Semiauto Senarmont which performs semi-automatic operations with the analyzer only manually rotated is also used.

The Senarmont method is an inspection method for measuring retardation quantitatively. An operator rotates the analyzer so that brightness of the part to be measured changes from the brightest state to darkest state, and measures its retardation by rotating the analyzer angularly. However, this conventional type has a problem such as the difference in decision of the brightness due to the difference in the condition during the measurement and also due to the difference in skill of each operator. Moreover, in Semiauto Senalmont, although the accuracy of retardation measurement has improved fron the visual observation type, the area to be measured is defined to the specific small portion in an image. Furthermore, in the Senalmont method, the direction of slow axis cannot be measured, and it only can be guessed, in consideration to the result of the sensitive color method. Moreover, when displaying 2D distribution is desired, many results measured and obtained much time is needed to map and measure the results.

This Fullauto StrainEye makes it possible to start measuring immediately by only putting a sample on the polarizer. Therefore, retardation values and the direction of the slow axis can be measured easily. The measurement result is not influenced by each pixel of differences of personal skill. Not only a specific part is not subjected to the measurement but all of each pixel of a built-in CCD camera measures the entire detecting part. Since the direction of retardation of retardation and a slow axis are 2D-displayed on a monitor, those direction states are recognized immediately by the operator.

This device is connected with a PC, and it is therefore feasible to save not only the measured data but also the observed image data easily.

With the use of super-luminescent LED as a light source, this detector is designed for long life and low power consumption. Accordingly maintenance and replacement of the light source as well as running costs can be reduced or dispensed with all together.

Screens for measurements according to Fullauto StrainEye
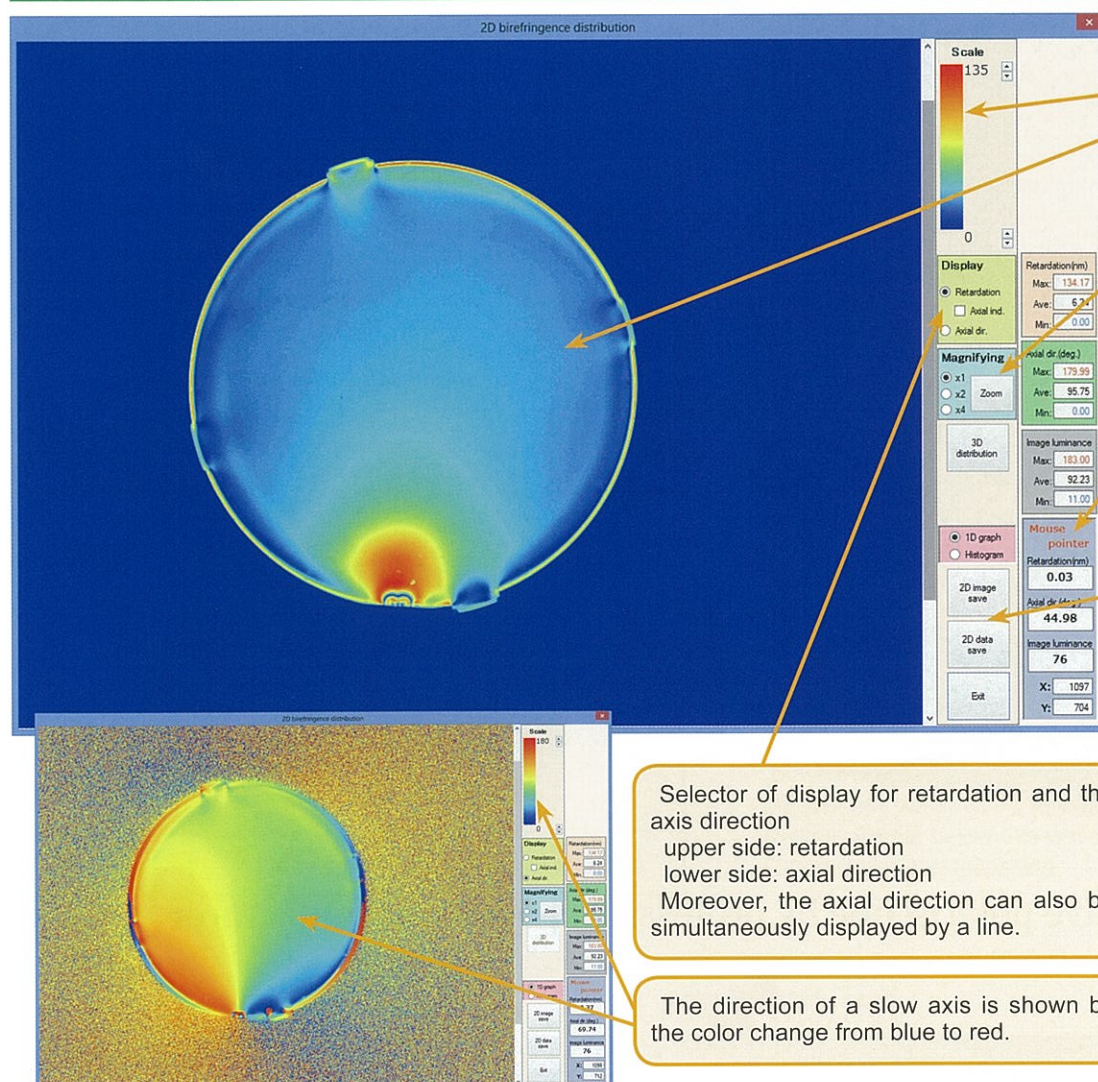
The quantity of retardation is displayed as 2D distribution by the color change from blue to red.
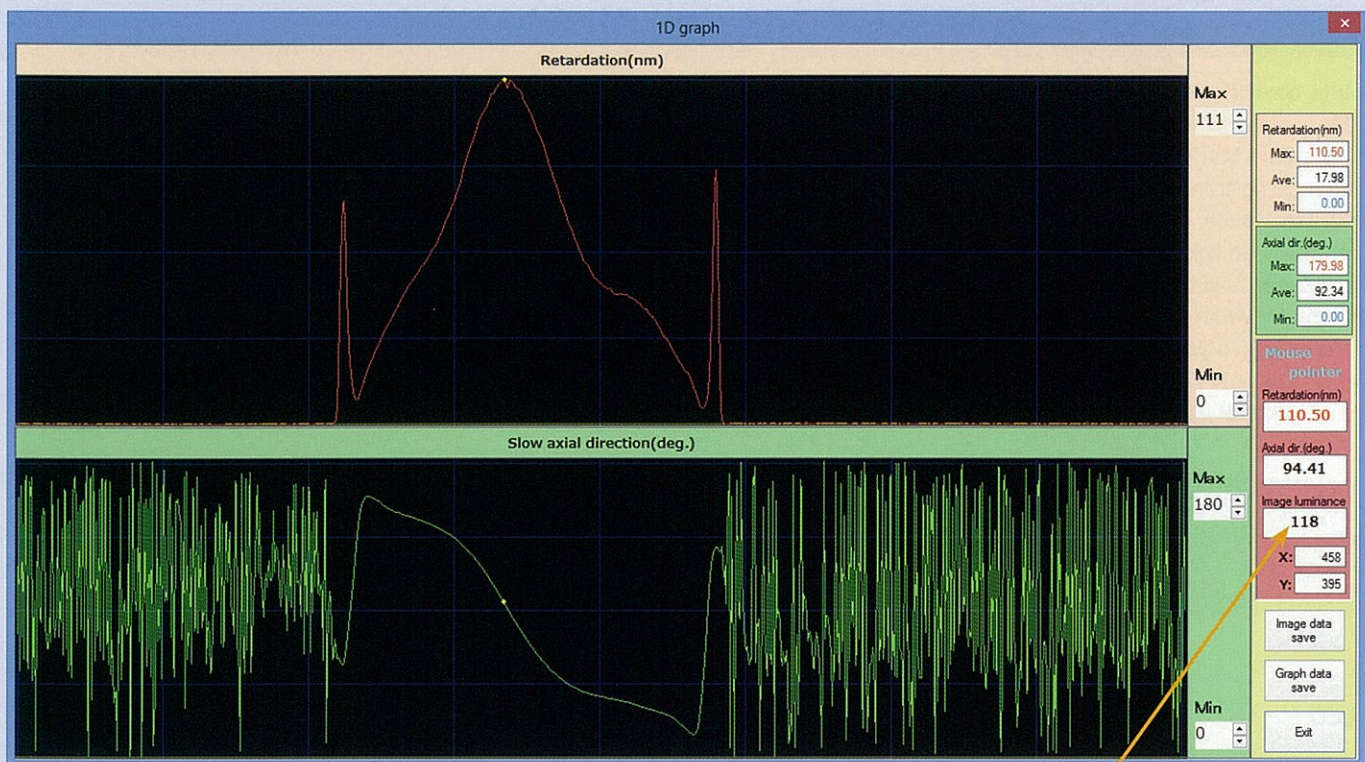
The image of 2D distribution size is able to change.

If a mouse cursor is placed on the image of the histogram, the digital data of the place will be displayed.

The 2D image data, and the data of distribution of retardation, and the data of the direction of the slow axis are stored.
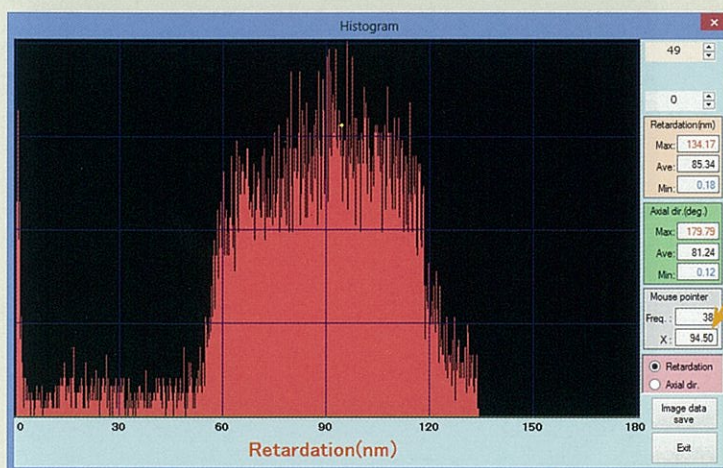
Selector of display for retardation and the axis direction
upper side: retardation
lower side: axial direction
Moreover, the axial direction can also be simultaneously displayed by a line.

The direction of a slow axis is shown by the color change from blue to red.

1D graph

Retardation(nm)

Slow axial direction(deg.)

Max 111 / Min 0

Max 180 / Min 0

Retardation(nm)
Max: 110.50
Ave: 17.98
Min: 0.00

Axial dir.(deg.)
Max: 179.98
Ave: 92.34
Min: 0.00

Mouse pointer
Retardation(nm)
110.50
Axial dir.(deg.)
94.41
Image luminance
118
X: 458
Y: 395

Image data save
Graph data save
Exit

The retardation data and the direction of the slow axis data are displayed as 1D graph which is corresponding with an arbitrary line drown on 2D birefringence distribution image.

If a mouse cursor is placed on the image of 1D graph, the digital data of the designated place will be displayed.

Histogram

49
0

Retardation(nm)
Max: 134.17
Ave: 85.34
Min: 0.18

Axial dir.(deg.)
Max: 179.79
Ave: 81.24
Min: 0.12

Mouse pointer
Freq.: 38
X: 94.50

◉ Retardation
○ Axial dir.

Image data save
Exit

Retardation(nm)

The retardation data and the direction of the slow axis data are displayed in histogram regarding the rectangle area defined arbitrary size on 2D birefringence distribution image.

If a mouse cursor is placed on the image of the histogram, the digital data of the designated place will be displayed.

3D distribution

Scale
135
0

Retardation(nm)
Max: 134.17
Ave: 50.24
Min: 0.00

Axial dir.(deg.)
Max: 179.95
Ave: 89.78
Min: 0.12

Image luminance
Max: 183.00
Ave: 96.36
Min: 11.00

3D image save
Exit

The retardation data is displayed as 3D image which is corresponding with an arbitrary square area defined on 2D birefringence image.
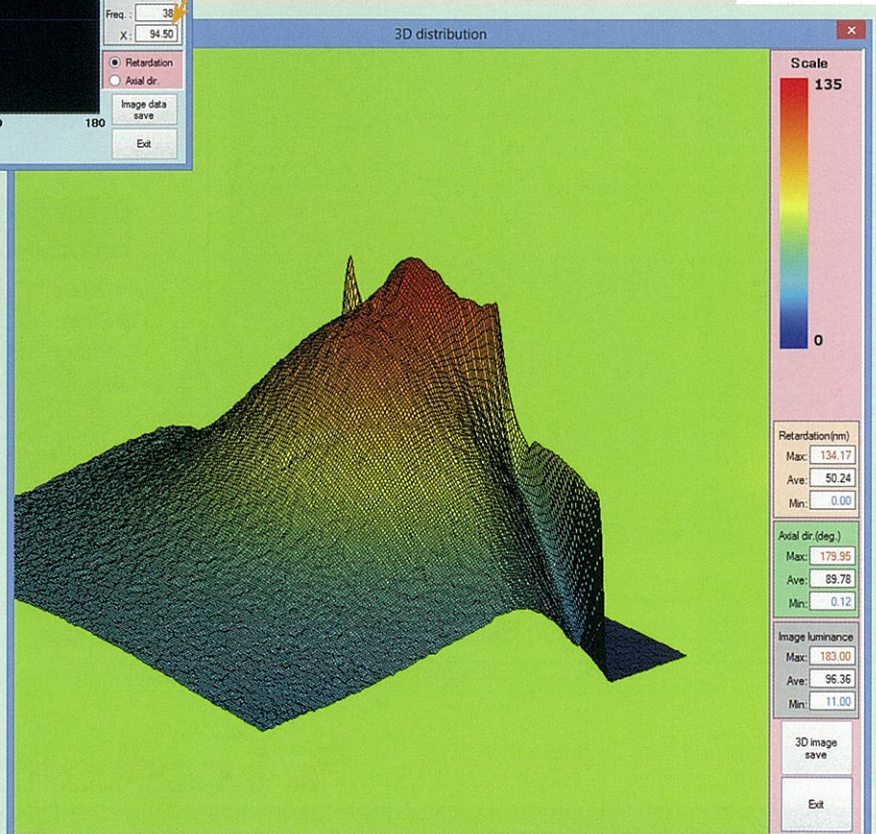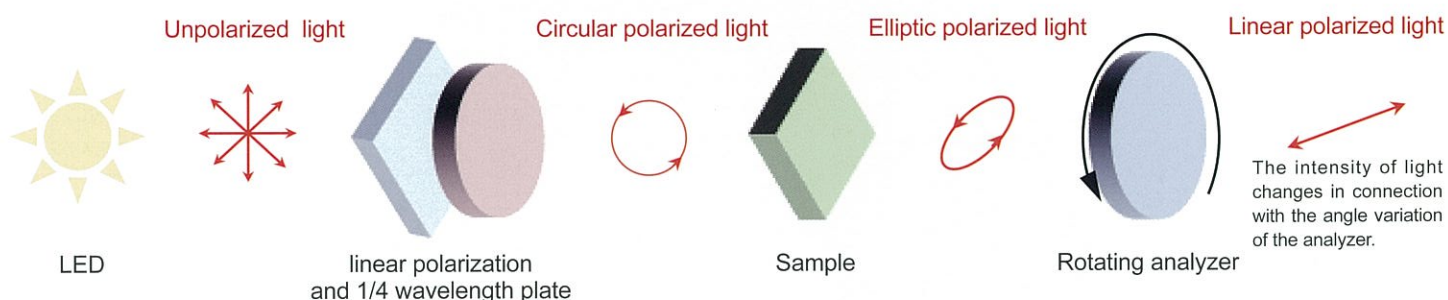
Analyzing Method

Fullauto StrainEye uses a "Rotating analyzer" method, in which only the analyzer is rotated against a fixed polarizer.

The light from the light source is converted into circular polarized light after being transmitted through the liner polarizer and the 1/4 lambda wave plate. When a sample having strain is placed in the circular polarized light, the circular polarized light is changed into an elliptic polarized light, after transmission through the sample, due to retardation between slow axis and fast axis in birefringence. Then, after the elliptic polarized light is transmitted through the rotating analyzer, the only lighting element included the elliptic polarized light and parallel with polarizing axis of the rotating analyzer is obtained the linear polarized light. In this case, such a linear polarized light has characteristics depending on the retardation and direction of the slow axis with the changed angle of the rotating analyzer. Fullauto StrainEye takes photographs at four predetermined angles of the analyzer, and deduces a polarization state such as an ellipticity and inclination of an ellipse from the light intensity in each angle.

Furthermore, Fullauto StrainEye estimates the quantity of retardation and direction of the slow axis from the difference between two states of polarization by measuring both states where the sample is settled or not settled.

| Unpolarized light | Circular polarized light | Elliptic polarized light | Linear polarized light |

LED | linear polarization and 1/4 wavelength plate | Sample | Rotating analyzer

The intensity of light changes in connection with the angle variation of the analyzer.

Product specification

Contents	Specification
Size (body)	W280×D340×H500mm
Weight (body)	15Kg
Circularly polarizing plate size	W200×D200mm
Sample placement space height	0～130mm
Inspection Method	Rotating analyzer method
Setting Wavelength	590mm
Repeat accuracy (standard deviation)	$\sigma=1$nm
Measurement area size	175×175mm
Effective pixels	1100×1100
Light Source	high-luminance LED
Power Source	AC100～240V 50／60Hz 0.35A
Component	Main body, PC, Cables
Accessory	Main body cover
OS	Windows 7 (32bit) / Windows 8 (32bit)

Shading on measurement

The mechanism does not measure unless the shutter is down providing darkness. Unnecessary light is eliminated and stable accuracy is obtained by this mechanism.

Purpose

- Quantitative measurement of residual stress in glassware
- Strain inspection for plastic products
- Phase difference measurement for optical film
- Strain Detection for crystalline material

Unmeasurable objects

Since the light source radiates as the wavelength of 590nm, the objects not transmitting at this wavelength are not inspected. Neither objects below this wavelength nor objects diffusing light can be accurately inspected.