

Application News

No. A595

Spectrophotometric Analysis

Pass/Fail Judgment of Automotive Window Tint Film Using the Spectral Evaluation Function of LabSolutions™ UV-Vis Software

Ultraviolet-visible spectrophotometers are used routinely in various industries for acceptance inspections of raw materials and quality inspections of products. In the construction and transportation equipment industries, ultraviolet-visible spectrophotometers are used as the reference for determining the transmittance of ultraviolet and visible light of window glass. However, inspections on these products require burdensome tasks, such as reading specific peaks or calculating the absorbance ratio of multiple peaks from the obtained data to judge the acceptability of products.

The LabSolutions™ UV-Vis software provides the spectral evaluation function as a standard feature so that inspections can be performed efficiently. This function automatically carries out analysis, including peak detection and calculation after spectrum measurement and makes a pass/fail judgment.

This article introduces an example of pass/fail judgments on commercially available automotive window tint film using the spectral evaluation function.

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■ Spectral Evaluation Function

The spectral evaluation function automatically carries out a pre-registered analysis on measurement results and enables pass/fail judgment to be made on these analysis results (evaluation values). Fig. 1 shows the detailed settings window of the spectral evaluation function.

Evaluation items include point pick, maximum value, minimum value, peak, and valley, and the ability to use these items individually or in combination makes it possible to support all kinds of evaluations.

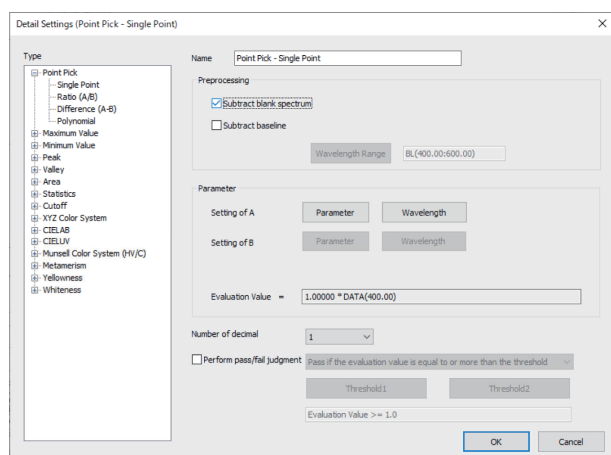


Fig. 1 Detailed Settings Window of the Spectral Evaluation Function

■ Transmittance Testing of Automotive Window Tint Film

Films that shield ultraviolet and visible light are sold as automotive parts. Such window tint film reduces the amount of intense sunlight and ultraviolet rays that shine on seats by shielding light in the ultraviolet to visible region. In this example we prepared two types of commercially available automotive window tint film that reduces ultraviolet rays by over 98 %, adhered each film to slide glass and measured the transmittance to determine the transmittance of the film adhered to glass. The transmittance of the slide glass itself was also measured as a control. Fig. 2 shows the picture of the samples.

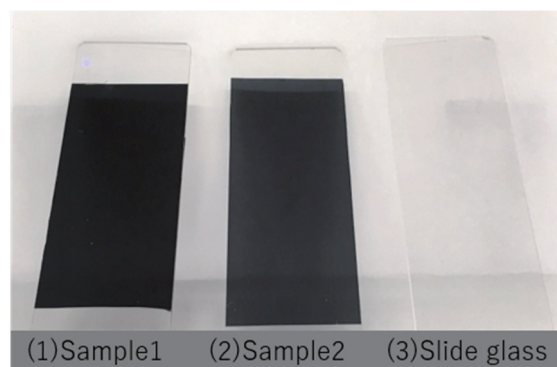


Fig. 2 Picture of Samples

We examined whether the transmittance in the ultraviolet region (270 to 350 nm) of each sample was less than 2 %.

Measurement was performed using the spectral evaluation function of LabSolutions UV-Vis software. The instrument used was a UV-1900 UV-VIS spectrophotometer. Fig. 3 shows the external appearance of the instrument and Table 1 lists the measurement conditions.



Fig. 3 UV-1900 UV-VIS Spectrophotometer

Table 1 Measurement Conditions

Measuring wavelength range	: 220 nm to 780 nm
Scan speed	: Medium speed
Sampling interval	: 1.0 nm
Slit width	: 1 nm
Light source changing wavelength	: 340 nm

First, the spectral evaluation item needs to be set. This function allows setting of multiple items that can be evaluated at the same time.

Fig. 4 shows the detailed settings window of the spectral evaluation function and Fig.5 shows an enlarged view. A pass judgment is obtained when the transmittance of 2 % or less is exhibited in the ultraviolet region (270 to 350 nm) in this experiment.

First under [Type], select [Maximum Value] and then [Single Point] ①. Next, set [Wavelength Range] ② under [Parameter] for the maximum value to be detected. In this example, the range was entered as 270 to 350 nm. Select the [Perform pass/fail judgment] check box ③ to set judgment criteria and select [Pass if the evaluation value is equal to or less than the threshold] ④ from the drop-down list. Lastly, set 2 % at [Threshold 1] ⑤ that defines the acceptance range.

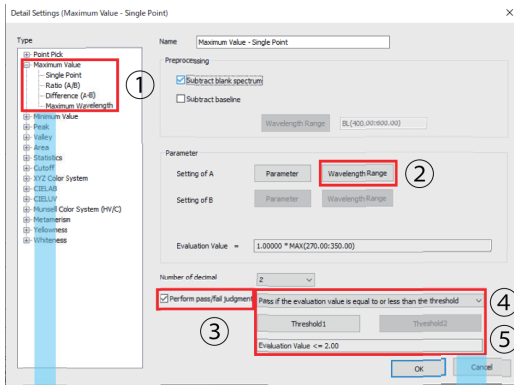


Fig. 4 Evaluation Detailed Settings Window

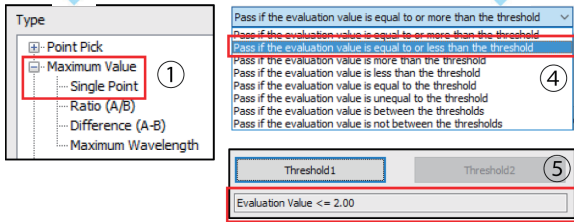


Fig. 5 Enlarged View of Evaluation Detailed Settings Window
① Evaluation Type ④ Evaluation Conditions ⑤ Threshold Setting

Click the [OK] button to set the spectral evaluation items shown in Fig. 6.

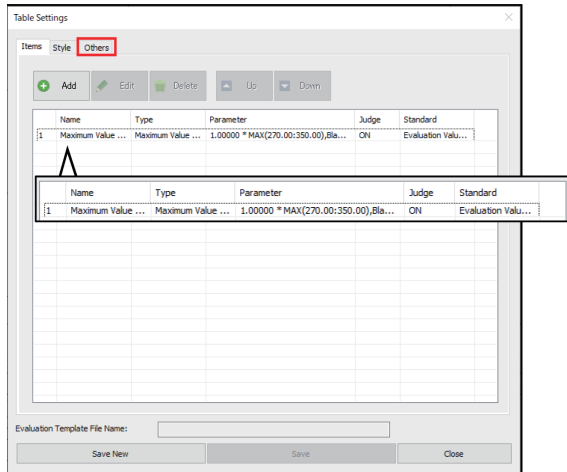


Fig. 6 List Showing Evaluation Item for Automotive Window Tint Film

Click the [Others] tab in Fig. 6 and select the [After measurement, data is automatically added to the evaluation table] check box to perform pass/fail judgment automatically after spectrum acquisition (Fig. 7). Also, saving an evaluation template allows you to perform the same test at any time simply by loading the template.

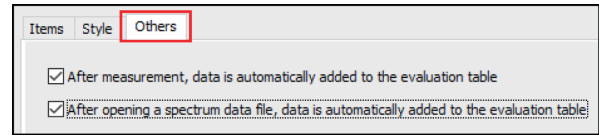
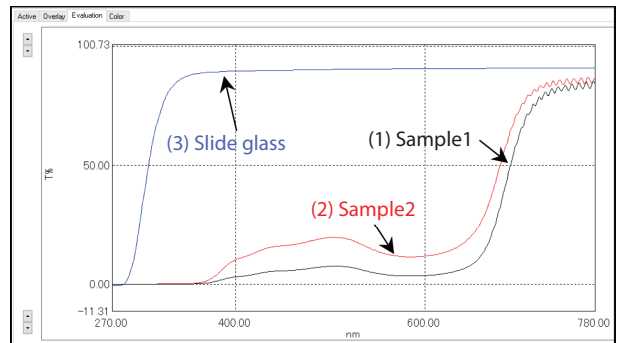


Fig. 7 Others Tab

Results

Fig.8 shows the obtained transmittance spectrum of each sample and the spectral evaluation results. (Fig.9 shows an enlarged view of the evaluation results.) "PASS" is indicated for the evaluation item of sample 1 and 2 since the maximum transmittance in the ultraviolet region was less than 2 % at 0.1 % and 0.4 % respectively. However, measurement of the slide glass only received a "FAIL" and is colored red in the table due to light transmission even in the ultraviolet region.

The column color in the evaluation result table changes when a result deviates from the set evaluation criteria and this allows you to determine at a glance whether a test has passed or failed. Moreover, this table information can be copied into other applications using the copy and paste function or the [Excel Export] function to facilitate creation of various reports.



Evaluation						
Filename: test.vspd						
Legend	Type	File Name	General Judgment	Maximum Value - Single Point Value	Judgment	Comments
1	SMP	①Sample1.vspd	PASS	0.1	PASS	
2	SMP	②Sample2.vspd	PASS	0.4	PASS	
3	SMP	③slide glass.vspd	FAIL(1)	87.7	FAIL	

Fig. 8 Measurement Results and Spectral Evaluation Results

Evaluation						
Legend	Type	File Name	General Judgment	Maximum Value - Single Point Value	Judgment	Comments
1	✓	SMP	①Sample1.vspd	PASS	0.1	PASS
2	✓	SMP	②Sample2.vspd	PASS	0.4	PASS
3	✓	SMP	③slide glass.vspd	FAIL(1)	87.7	FAIL

Fig. 9 Enlarged View of Spectral Evaluation Results

Conclusion

This article introduced an example of how transmittance of automotive window tint film in the ultraviolet region is efficiently determined to be below a reference value by using the spectral evaluation function of the LabSolutions UV-Vis software. The use of this function enables various quality inspections with great efficiency.

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