

Application News

No. A555

Spectrophotometric Analysis

Measurement Examples of Small Samples and Small Areas

- Utilizing a Micro Sample Holder and Micro Beam Lens Unit -

Daily technical progress makes it possible to process small objects and small areas. Therefore, there are increasing needs for measuring the characteristics of such small samples and small areas.

Here, we describe an example of utilizing a UV-VIS spectrophotometer with a micro sample holder and a micro beam lens unit to meet the above needs.

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■ Sample Measurement with a Micro Sample Holder

Fig. 1 shows a micro sample holder which can hold a solid sample of about 5 to 10 mm in diameter or squared and about 1 to 5 mm thick. Three commercial band-pass filters of about 10 mm in diameter were set as shown in Fig. 2 and measured. Table 1 shows the analytical conditions and Fig. 3 shows the obtained transmittance spectra. The specified center wavelength of each filter is 500 nm, 730 nm, and 905 nm (tolerance 2 nm) respectively. The peak wavelength in their measured spectra is observed at almost the same wavelengths as written above.

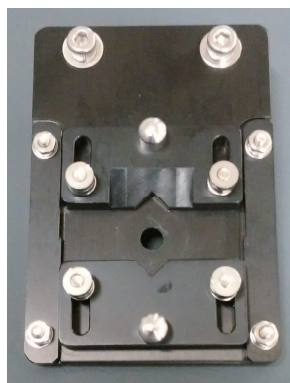


Fig. 1 Micro Sample Holder

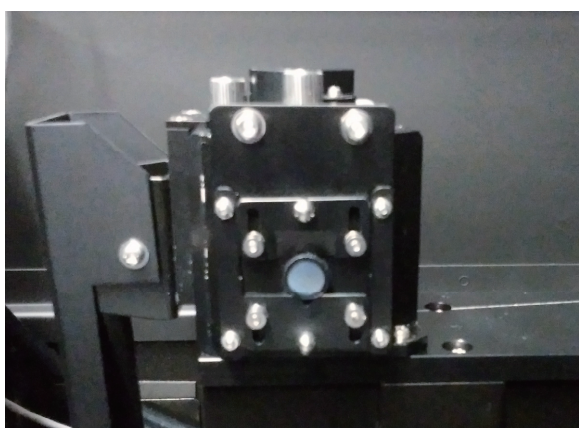


Fig. 2 Micro Sample Holder with a Sample Set on an Integrating Sphere

Table 1 Analytical Conditions

Instrument Used	: UV-2600, MPC-2600A
Measurement	: Micro Sample Holder
Wavelength Range	: 350 to 800 nm/850 to 1050 nm
Scanning Speed	: Low speed
Sampling Pitch	: 1.0 nm
Slit Width	: 2.0 nm (Using mask provided with MPC)

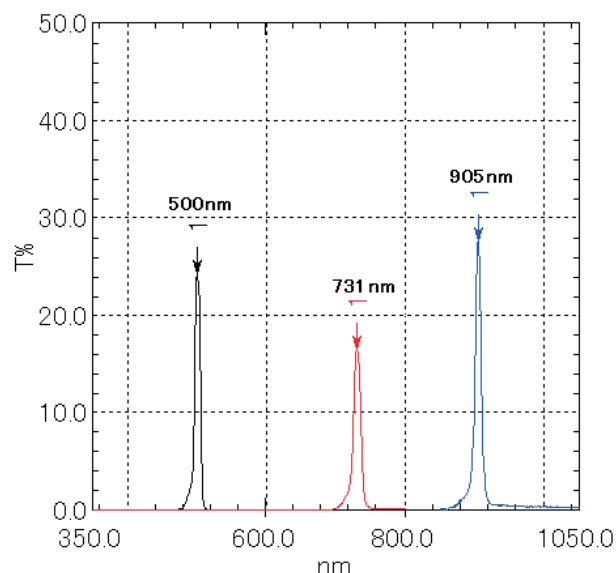


Fig. 3 Transmittance Spectra of Band-Pass Filters
Black: Center WL of 500 nm, Red: Center WL of 730 nm,
Blue: Center WL of 905 nm

Measurement of Small Areas Using a Micro Beam Lens Unit

Fig. 4 shows a micro beam lens unit, which is capable of focusing light down to approximately $\phi 1$ mm. In addition, it can focus light at the center of the integrating sphere window or on the sample surface when it is used with a micro sample holder. In this example, small areas (2-mm square area) on a patterned film as shown in Fig. 5 were measured. Table 2 shows the analytical conditions and Fig. 6 shows the obtained transmittance spectra. Since each area had a different color, the measured transmittance spectra showed absorptions in the wavelength range corresponding to the color. Table 3 shows the color values calculated with the transmittance spectra. Fig. 7 and Fig. 8 show the color space of each area and the $L^*a^*b^*$ color space, respectively. The $L^*a^*b^*$ color coordinate system is used to represent the color of a body, where L^* represents lightness, and a pair of a^* and b^* represents hue and chroma (saturation). It was confirmed that there was a correlation between visual color and the measurement results.

Table 2 Analytical Conditions

Instrument Used	: UV-2600, MPC-2600A
	Micro Beam Lens Unit
Measurement Wavelength Range	: 350 to 800 nm
Scanning Speed	: Medium speed
Sampling Pitch	: 1.0 nm
Slit Width	: 5.0 nm (Using mask provided with MPC)



Fig. 4 Micro Beam Lens Unit



Fig. 5 Patterned Film and Measurement Area

Table 3 Color Values (D65, Viewing Angle of 2 Degrees)

Area	Visual Color	L^*	a^*	b^*
1	Orange	92.68	2.74	13.32
2	Yellow green	96.41	-8.08	20.89
3	Light blue	92.38	-11.65	-5.55
4	Light green	92.04	-13.97	19.32
5	Green	86.76	-21.38	10.09

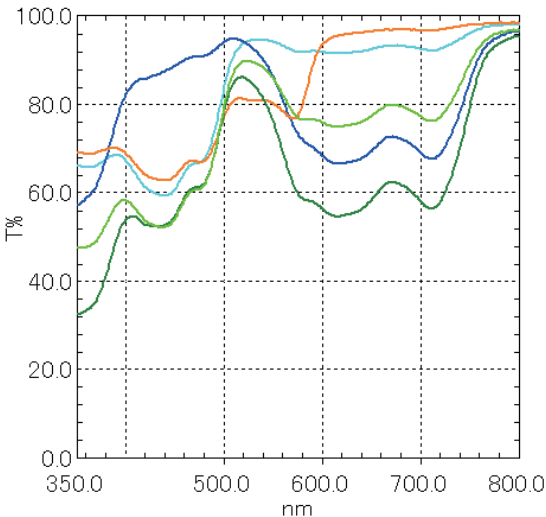


Fig. 6 Transmittance Spectra of Colored Areas in Patterned Film
Orange: Area 1, Light Blue: Area 2, Blue: Area 3, Yellow Green: Area 4, Green: Area 5

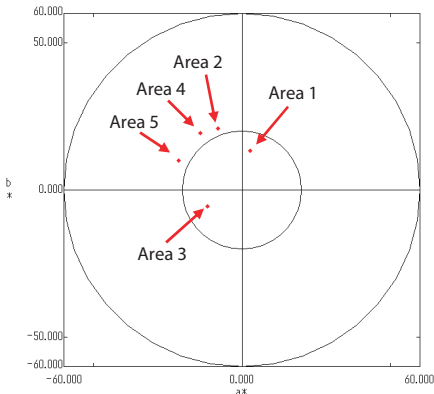


Fig. 7 Color Space of Each Area

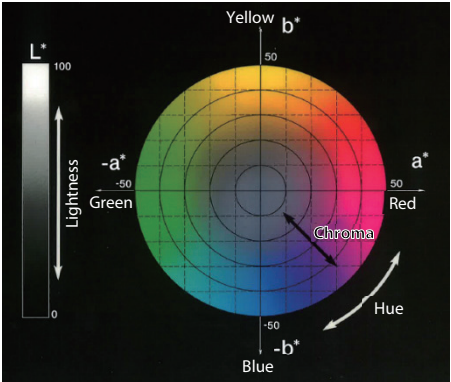


Fig. 8 $L^*a^*b^*$ Color Space

Conclusions

Small band-pass filters were held easily and measured with a micro sample holder. Small areas on a patterned film were measured with a micro beam lens unit. Various types of samples and a small area can be measured with accessories suitable for them.

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