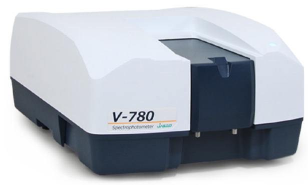
Application Note
UV-0010

High Sensitivity Near Infrared Absolute Reflectance Measurement of Materials

Introduction

The evaluation of materials used in optical communication devices often requires high sensitivity measurements in the near infrared region. The optical elements that are used, such as band pass and cut-off filters, are designed to preferentially select the wavelengths that are used for the communication signal and reject the wavelengths that contribute noise. The filters must be designed so that the maximum signal amplitude is obtained after passing through the optical element.



V-780
UV-Visible/NIR Spectrophotometer

This application note demonstrates the high sensitivity measurement of optical elements using a V-780 with an InGaAs detector.

Keywords

V-780, UV-Visible/NIR, Materials, Near-infrared, InGaAs detector

Results

Comparison with PbS Detector

Figure 1 shows the results for a 1.3 µm band frequency cut-off filter used for optical communications. The spectra were obtained using two different V-700 UV-visible/NIR spectrophotometers; one using a PbS detector (V-770) and the other an InGaAs detector (V-780). As seen in Figure 1, the spectra obtained with the InGaAs detector shows a much higher S/N than those with a PbS detector.

JASCO INC.
28600 Mary's Court, Easton, MD 21601 USA
Tel: (800) 333-5272, Fax: (410) 822-7526
Application Library: http://www.jascoinc.com/applications

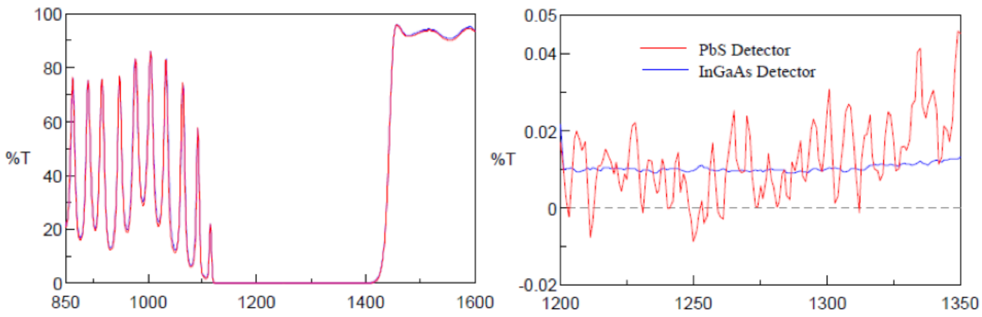


Figure 1. Transmission spectra of 1.3 µm band frequency cut filter. The spectrum (left) was zoomed in between 1200 and 1350 nm to illustrate the difference in S/N between the two detectors.

High Resolution Measurement

Figure 2 shows the results of a 1050 nm laser cut filter at varying spectral bandwidths. Small bandwidths enable high-resolution visualization of the edge of the cut-off filter, as well as the interference curve of a multi-layer filter. Both characteristics are not observed at larger bandwidths and at the smallest bandwidth – 0.2 nm, good S/N is still maintained.

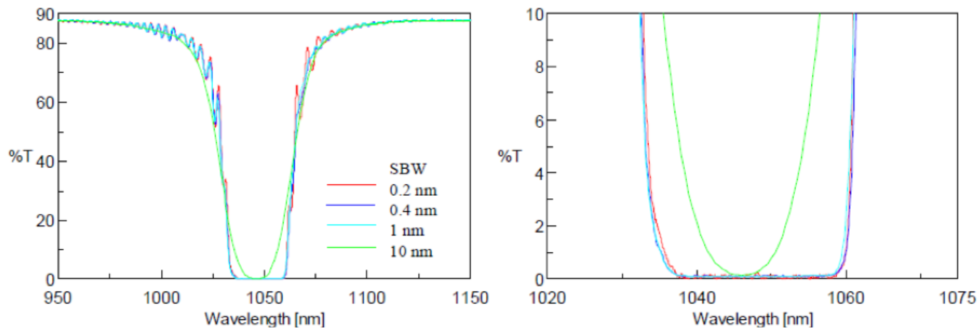


Figure 2. Transmission spectra of a 1050 nm laser cut-off filter at varying bandwidths. The spectrum (left) was zoomed in between 1020 and 1075 nm to illustrate the higher S/N.

Measurement Conditions				
Measurement Range	1150-950 nm			
Response	Slow			
Bandwidth	0.2 nm	0.4 nm	1.0 nm	1.0 nm
Scan Speed	10 nm/min	10 nm/min	20 nm/min	200 nm/min
Data Interval	0.05 nm	0.1 nm	0.2 nm	0.5 nm

JASCO INC.
28600 Mary's Court, Easton, MD 21601 USA
Tel: (800) 333-5272, Fax: (410) 822-7526
Application Library: http://www.jascoinc.com/applications

High Scan Speed Measurement

Figure 3 shows the results of a 1.3 µm band frequency cut-off filter at varying scan speeds. The data indicate that even at the maximum scan speed of 400 nm/min, good S/N and spectral shape are well maintained.

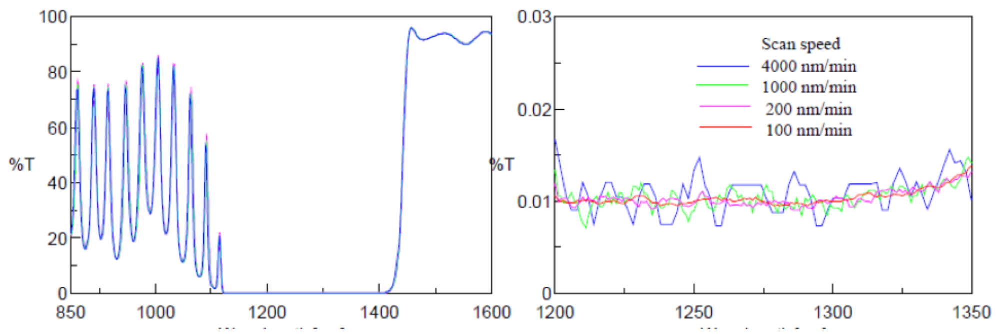


Figure 3. Transmission spectra of 1.3 µm band frequency cut filter. The spectrum (left) was zoomed in between 1200 and 1350 nm to illustrate the high S/N.

Measurement Conditions				
Measurement Range	1600-850 nm			
Bandwidth	4.0 nm			
Response	Quick	Fast	Medium	Slow
Scan Speed	4000 nm/min	1000 nm/min	200 nm/min	100 nm/min
Data Interval	2 nm	1 nm	1 nm	1 nm

Variable Angle Measurement using the Integrating Sphere

The absolute reflectance measurement system with an integrating sphere was used to measure a 1050 nm laser cut-off filter. Figure 4 shows the measurements at varying incident angles with a spectral a bandwidth of 1 nm. While integrating spheres are known to decrease sensitivity, the use of the InGaAs detector with the integrating sphere enables high S/N and resolution.

JASCO INC.
28600 Mary's Court, Easton, MD 21601 USA
Tel: (800) 333-5272, Fax: (410) 822-7526
Application Library: http://www.jascoinc.com/applications

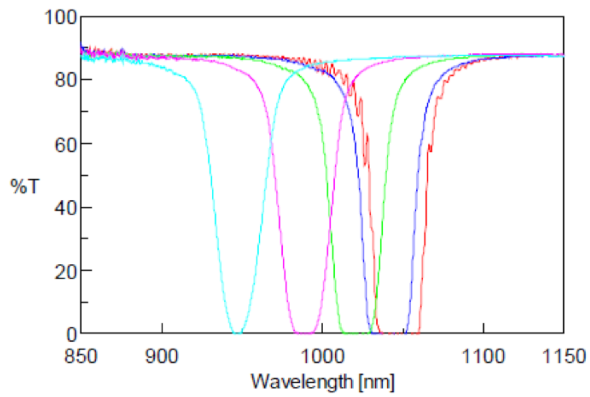


Figure 4. Transmission spectra of a 1050 nm laser cut filter at the following incident angles: 0 (red), 10 (blue), 20 (green), 30 (pink), and 40 (teal) degrees.

Measurement Conditions			
Response	Fast	Bandwidth	1.0 nm
Scan Speed	200 nm/min	Data Interval	0.2 nm

JASCO INC.
28600 Mary's Court, Easton, MD 21601 USA
Tel: (800) 333-5272, Fax: (410) 822-7526
Application Library: http://www.jascoinc.com/applications